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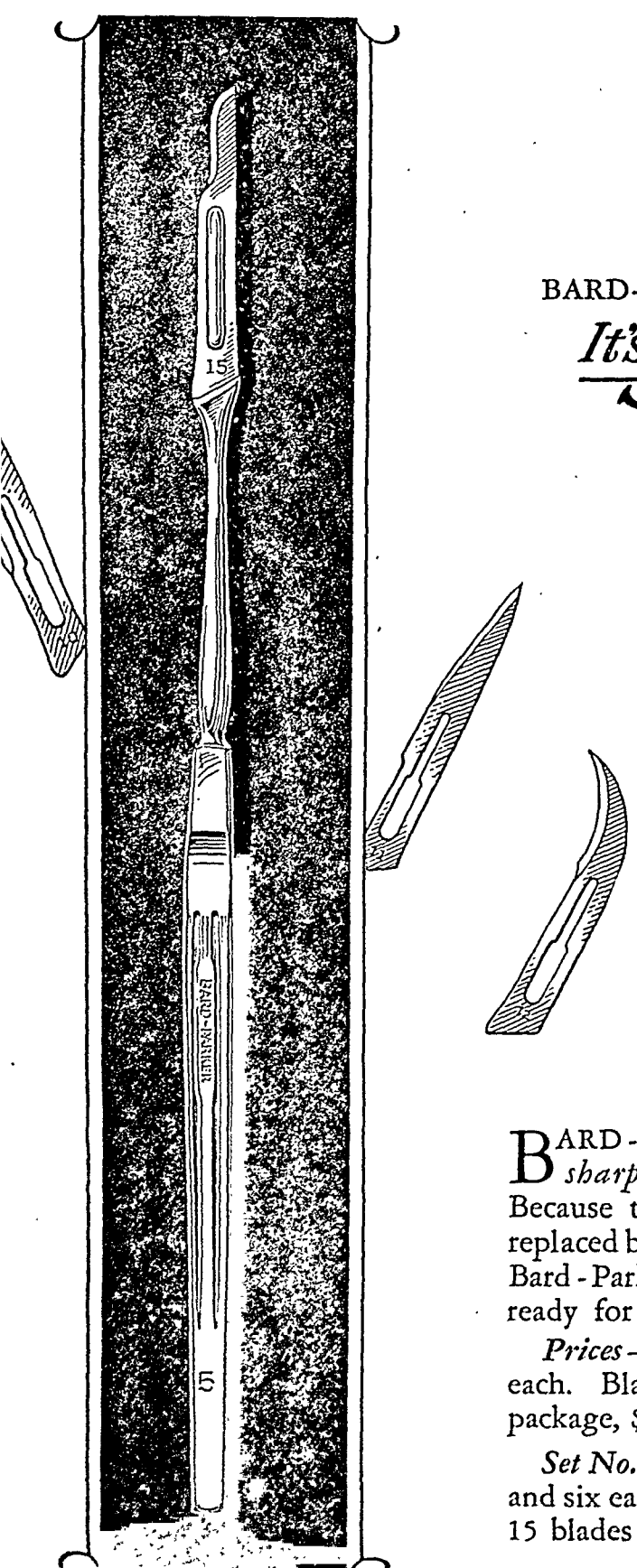
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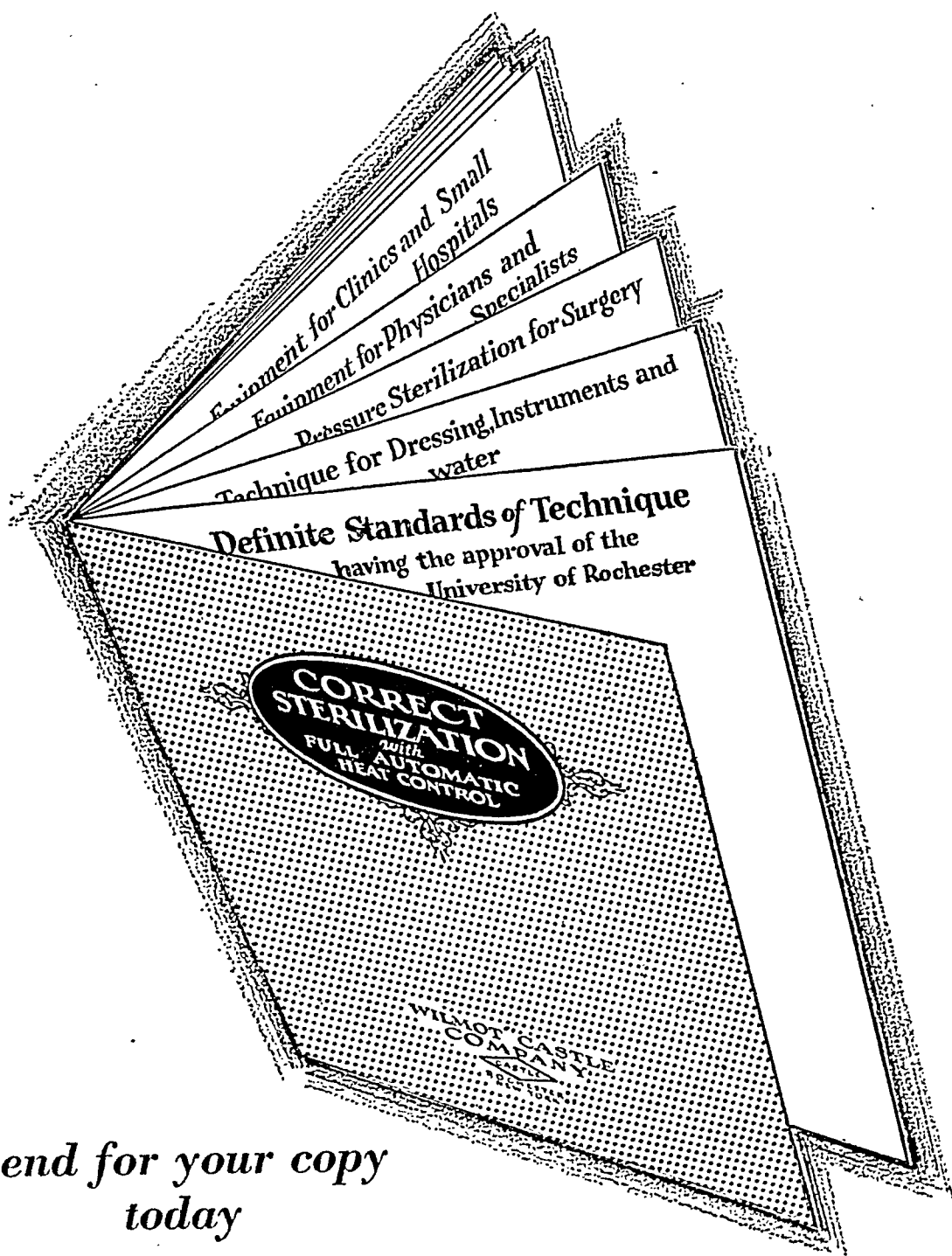
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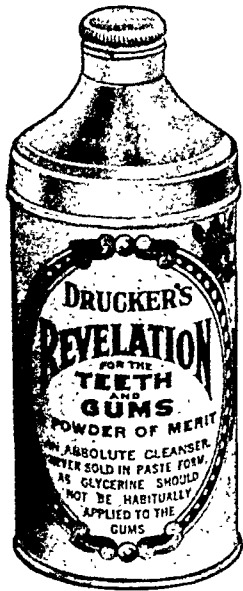
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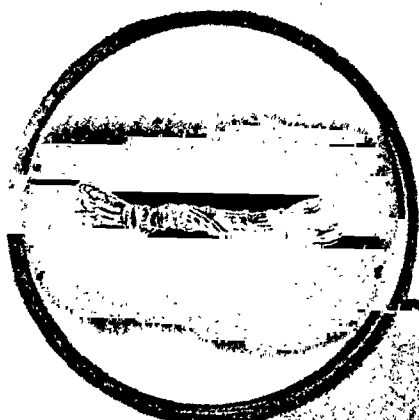
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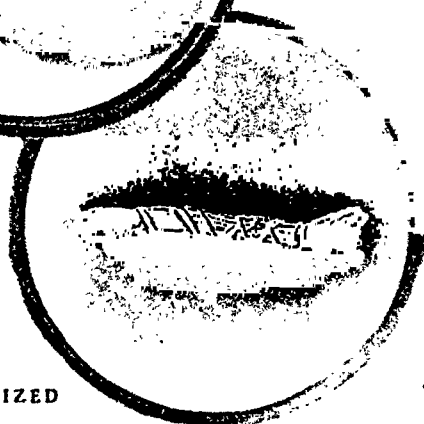
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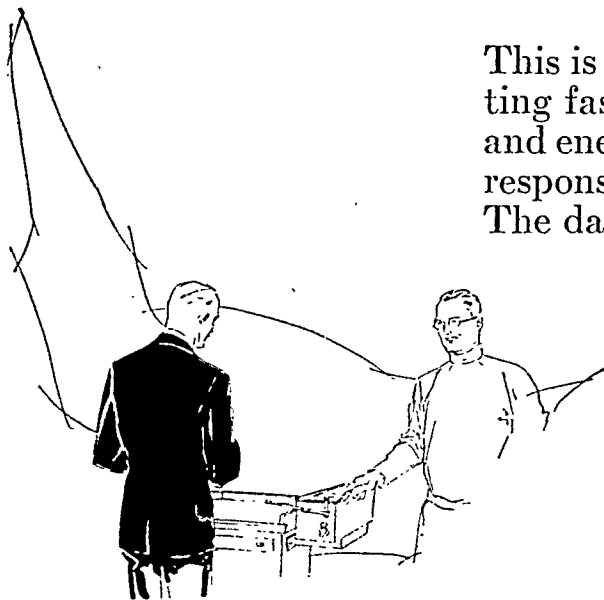
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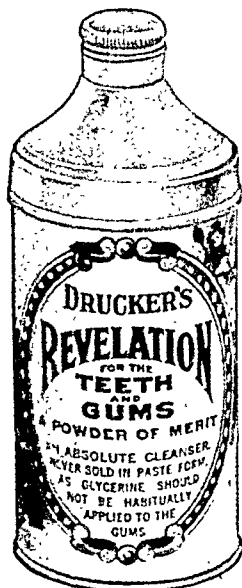
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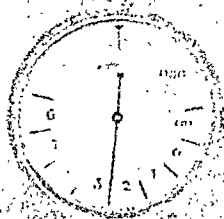
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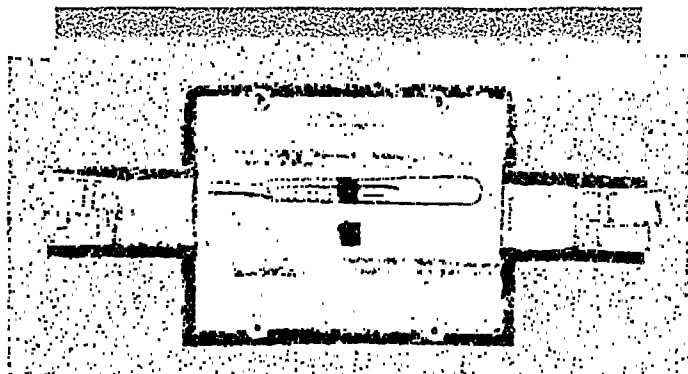
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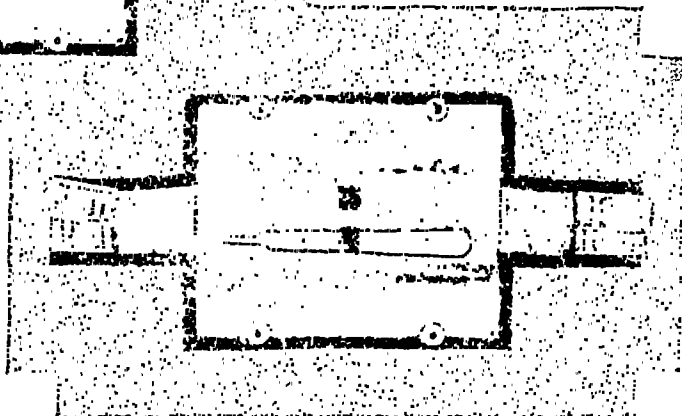
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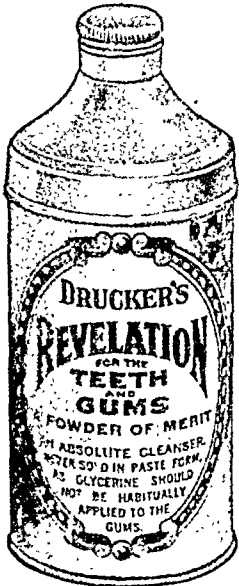
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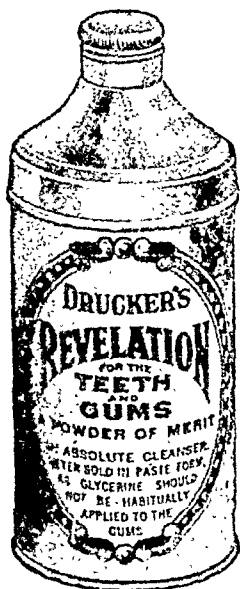
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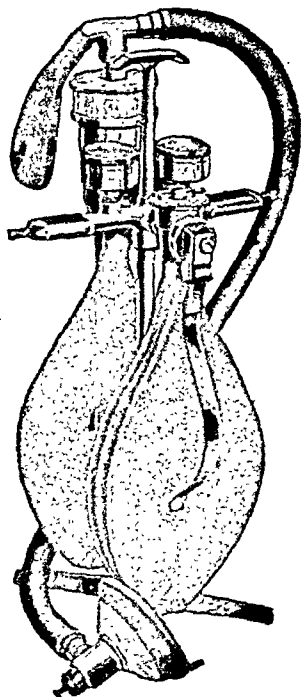
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# The American Journal of Obstetrics and Gynecology

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## Original Communications

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### RADIOTHERAPY IN CARCINOMA OF THE OVARY

BY FRANCES A. FORD, M.D., ROCHESTER, MINN.

*(From the Section on Radium and Roentgen-Ray Therapy, Mayo Clinic)*

ATTENTION has recently been directed to the varied experiences with irradiation of ovarian carcinoma. The rapid growth of ovarian carcinoma, the marked tendency to metastasis through the profusion of blood and lymph channels, the facility to spread to neighboring organs and the easy propagation by peritoneal implantation make surgical cures difficult. The value of radiotherapy either as a means of palliation of symptoms or of arrest of growth when it has been impossible to remove the entire lesion surgically, is difficult to assess independently, since operative procedures with variable responses have recently preceded irradiation in the majority of cases. In an attempt to gain a clearer judgment of the subject we have studied the results in cases of ovarian carcinoma treated by radiotherapy in the years 1920 to 1923, inclusive, at the Mayo Clinic, and have assembled comparative data in the literature.

#### CLASSIFICATION OF TUMORS OF THE OVARY

The frequency of occurrence of tumors of most varied types in the ovary has been the occasion of numerous histologic studies of the pathogenesis, but no entirely satisfactory classification covering both clinical and anatomic features of the tumors has been presented. Gebhardt has divided carcinomas of the ovary into two classes: genuine idiopathic which develop directly from the unchanged ovarian tissue; and cystic which either develop from benign ovarian cysts through carcinomatous transformation or start as carcinomatous cysts. Döderlein, discussing

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NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."

Pfannenstiel's<sup>17</sup> complete classification of ovarian neoplasms on the basis of origin, whether from parenchyma, germ cells, or stroma, emphasizes the impossibility of making an absolute diagnosis of malignancy on histopathologic observations alone, since many ovarian tumors which cannot be so classified are proved malignant by the subsequent clinical course. He presents the following grouping based on clinical observations and anatomic studies: (1) definitely benign tumors, including simple serous cystomas, cystic embryomas (dermoids), fibromas, pseudomucinous cystadenomas and solid adenomas; (2) definitely malignant tumors, including carcinomas, sarcomas, and endotheliomas; (3) relatively malignant tumors, including the papillary serous cystadenomas, pseudomyxomas and the solid embryomas or teratomas. On a descriptive basis, the pathologists of the Mayo Clinic report malignant tumors of the ovary as (1) adenocarcinoma, (2) solid carcinoma, or (3) papillary carcinomatous cystadenoma of either the intracystic or extracystic type. Since in discussing prognosis definite pathologic entities must be considered, in my review no operative case has been included unless a report of carcinoma was given by the pathologist. I have, however, included two nonoperative cases in which the probable diagnosis was substantiated by clinical features and history. In reports in which the diagnoses have not been checked by microscopic examination there is a probability that cases of relatively malignant types are included and alter the result.

It is necessary to differentiate clearly primary and secondary ovarian carcinomas. While metastatic ovarian carcinoma was believed, by early pathologists, to be rare, Bucher, in a series of necropsies, found that bilateral ovarian carcinoma, considered primary at previous operation, occasionally proved to be secondary, the original carcinoma usually lying in the stomach or lower in the gastrointestinal tract. Schlagenhauser assembled from the literature seventy-nine cases in which both ovaries were involved; in sixty-one the primary carcinoma occurred in the stomach, in ten in the intestine, in seven in the gall bladder, and in one in the suprarenal gland. The extent of metastasis to the ovary is likely to overshadow the primary growth. Careful palpation of stomach and intestinal tract at the time of operation is necessary to preclude the presence of a primary growth. On the other hand, when carcinoma is primary in the ovary, metastasis may occur throughout the body. Coexistence of independent gastric and ovarian carcinomas and of uterine and ovarian carcinomas has been established by the distinctive pathologic features of the tumors. Frankl in eleven cases of concomitant ovarian and uterine carcinoma established two as primary in the ovary, and three as primary in the uterus; in six instances he could find no relation between the carcinomas. Pfannenstiel<sup>16</sup> has suggested that the ovarian carcinoma is usually primary when associated carcinoma involves nearby organs, whereas it is more likely metastasis if the other carcinoma lies in a distant organ. In general, one

inclines to the view that ovarian carcinoma, coexistent with carcinoma of another organ, is secondary.

In a number of series of cases of ovarian tumor malignancy was found in approximately 10 per cent. Sarcoma of the ovary has been reported in infancy and early childhood and reaches the peak of its incidence at about the second decade when embryonic teratoma is also relatively common. Carcinomas are reported from the second decade until late in life, the highest incidence being reached in the fifth and sixth decades. Ovarian tumors are often symptomless until far advanced; this is especially true of carcinomatous growths which early become bilateral. The symptoms which have been noted most frequently are abdominal distention (due to ascites), pain, and amenorrhea or other menstrual disturbances. Since it is impossible by clinical examination to distinguish malignant from benign or relatively malignant ovarian growths, immediate operation should follow the discovery of every ovarian tumor. Nonpapillary or glandular pseudomucinous cystadenoma is benign, about 98 per cent of the patients with this lesion remaining well after operation. In a few cases, however, true carcinoma develops following partial removal of the tumor. In relatively malignant conditions, such as papillary serous cystadenoma, there is a greater percentage of malignant recurrence. Glockner found recurrence in 11 per cent and Pfannenstiel in 23 per cent after four or five years. In all cases of papillary growths bilateral salpingo-oophorectomy with hysterectomy is the operation of choice. If the papillary growth has broken through the surface of the tumor, ascites is usually present, and, in about 13 per cent of the cases observed, implants on the peritoneum have occurred, giving a malignant aspect. However, metastasis by way of blood or lymph stream does not occur, nor does one find the cellular characteristics of carcinoma, such as anaplasia and infiltrating destructive growth, but only a marked proliferative tendency of the epithelium. It is a known fact, but unexplained, that occasionally in cases in which there have been residual papillary implants on the peritoneum, complete cure results with the disappearance of these implants without further treatment.

Carcinoma of the ovary is bilateral in the majority of cases at the time of operation. Even in advanced diseases exploration is justifiable and may be substituted for paracentesis, since the small incision is of little more significance than the puncture wound and the evacuation of fluid is more thorough. Decided temporary improvement often results; the opportunity for accurate diagnosis is afforded. From 30 to 45 per cent of cases will prove operable. Bilateral salpingo-oophorectomy and hysterectomy are advocated even in cases of unilateral involvement and in spite of the high primary mortality, since the remaining ovary and uterus are the sites of predilection in the event of recurrence. According to Glockner's survey, in 61.6 per cent of

the cases free from recurrence the uterus had been removed, whereas hysterectomy had been performed in only 36.3 per cent in which there was recurrence. The conservation of the remaining ovary to guard against distressing symptoms of the menopause is of questionable value in view of the gravity of the prognosis. Hofmeier reported full-term pregnancy with delivery of a normal child occurring after operation in two of eighteen cases of unilateral ovarian carcinoma, in which one tube and ovary only were removed. Rochet reports a similar case in which intensive postoperative irradiation was given while the remaining ovary was protected. A normal child was born one year later and the patient was free from recurrence when last seen, two years after operation. Such conservative measures must be used only in selected cases.

Döderlein recommends incision into the remaining ovary since it may occasionally present a normal exterior but shows evidence of disease on section. Polak has noted that the conserved ovarian tissue, if diseased, rarely fulfills the desired function and adds to the distress of ensuing vascular phenomena.

#### RESULTS OF OPERATION

The immediate mortality for panhysterectomy in cases of malignant tumor of the ovary is high: Döderlein reporting 15.7 per cent; Zweifel 13.3 per cent; Schäfer 17 per cent, and Winter 24 per cent. The extent of malignant growth at the time of operation is of paramount importance in the prognosis, and of less importance the type of tumor. The experience of various surgeons is briefly noted.

Fromme found recurrence in 43 per cent of cases of unilateral ovarian carcinoma, within from one and a half to three years. Hofmeier reported thirty cases in which operation had been performed for unilateral involvement, in fifteen of which death had occurred: in ten in the first year, in two in the third, in one in the fourth, and in one in the eighth year. In the remaining fifteen, five years had not elapsed since operation. Schäfer reports seventy cases of primary ovarian carcinoma in which operation was performed with a primary mortality of 17 per cent (twelve cases); in the remaining fifty-eight cases operation was described as complete in forty-one, residual malignant tissue being left in seventeen. In twenty-five there was unilateral involvement, and in eleven of these (44 per cent) the patient remained well for more than five years. Only twelve of the total number (17.14 per cent) remained well for more than five years, including only one patient with bilateral involvement. Panhysterectomy was performed in fifteen cases of unilateral carcinoma and in seven there has been no further trouble; extirpation of one adnexum was performed in nine and in three there has been no recurrence; in the one case in which both adnexa were removed there has been no recurrence. Döderlein considered continued cures after operation for bilateral involvement so few as to permit of individual listing. He mentioned two cases presented by Pfannenstiel, two by Fritsch, one by Tannen, and two by Freund. Glockner found 100 per cent recurrence in a group of ten such cases, and Hofmeier reported nine deaths within three years in a similar group of ten; in the remaining case operation had been performed only a year before.

Without differentiation of extent or type of growth, but with exclusion of all cases with metastasis, Glockner, after a five year period of observation, found 29

per cent continued cures in cases of ovarian carcinoma. In the first year 54.5 per cent of the recurrences appeared; in the second year 22.7 per cent; in the third year 9.1 per cent; in the fourth year the same percentage, and the seventh year 4.5 per cent. Pfannenstiel reported recurrence in 74 per cent after four years; Heinricius in 80 per cent. After another year the percentage of continued cures in this group fell to 14.6. Döderlein reported that ten of seventy-two patients operated on are alive; however, only six of these were operated on more than five years previously.

Codman reviewed forty-one cases operated on at the Massachusetts General Hospital during a period of twenty-five years. All but two of the patients had died; Both had a colloid type of carcinoma; one was living after nine years and the other after more than four. Of the thirty-nine who had died, 74 per cent had survived less than one year. Cameron found that the average length of life after operation in his patients was from five to six months. The most favorable result in this group was in a case in which the patient lived nine years after operation before inoperable recurrence developed. Schmitz found recurrence after complete surgical extirpation in 85 per cent of cases of papillary carcinoma and in 65 per cent of nonpapillary carcinoma. Norris and Vogt concluded that prognosis was less favorable in cases of primary malignant lesion of the ovary than in cases of malignant degeneration of ovarian cysts.

#### IRRADIATION OF OVARIAN CARCINOMA

Improvement in these statistics will be the result of (1) earlier diagnosis, which apparently may be realized only through periodic physical examinations, including thorough gynecologic examination, since the disease develops insidiously and is often without symptoms until it is far advanced, and (2) supplementary treatment which may prevent recurrence or arrest the development of residual growths.

Radiotherapy has been the most promising supplementary treatment as yet tested.

Orbaan in 1920 reported eleven cases of ovarian carcinoma in which radiotherapy had been used, in half of the cases with benefit. Permanent cure was effected in one case, and in two cases the patient was well for three years. In seven cases in which the disease was advanced, there was benefit; in three earlier cases, however, there was no benefit from treatment. Dreuschuck and Lovas reported marked success in the treatment of two cases of inoperable carcinoma with extensive metastasis; one patient was regarded as clinically cured and the second as definitely improved. They found that severe reactions and bad results followed irradiation in some cases. Norris and Vogt found postoperative irradiation with either roentgen rays or radium uniformly unsuccessful in the small series in which they employed it. Holmes and Dresser have noted that there was marked improvement in certain cases of generalized abdominal carcinomatosis under irradiation, but in all cases relief was only temporary. Phillips treated three cases of carcinoma of the ovary with irradiation; in one case in which exploratory operation had been followed by irradiation, all clinical symptoms disappeared completely during a period of one and a half years. The growth then recurred and proved fatal. In one case of generalized carcinomatosis of the abdominal cavity no benefit resulted from treatment, and in a third case treatment was prophylactic after complete extirpation and the patient remained in good health. Walthard reported two cases in which radiosensitive car-

cinomas of embryonal origin were observed. In one case the ovarian tumor had been extirpated, a radical operation and transverse resection of the sigmoid flexure having been performed. After eight months extensive recurrence in the peritoneum and through the pelvis and vagina was noted and treated with radium. Six and a half years after treatment the patient was well. In the second case, a patient, aged twenty-three, was treated with roentgen rays for a tumor which filled the abdomen and pelvis. After nine weeks the tumor was reduced to a small mass which was easily removed and the patient was free from recurrence three and a half years later. Codman reported five cases from private practice (diagnosis not checked microscopically) treated by irradiation, two with marked success. Strassman re-reported thirty-two cases in which operation for ovarian carcinoma was not followed by irradiation, and in all of which death occurred, whereas twenty patients treated postoperatively by irradiation were still alive; 5 per cent, however, had been treated less than six months before, ten less than two and a half years before, and only two more than five years before. Strassman considered irradiation important in direct proportion to the size of the tumor removed at operation. Keene, Pancoast, and Pendergrass have reported twenty-four proved cases of carcinoma of the ovary treated with roentgen rays. In all cases the primary growth was incompletely removed at operation, or definite recurrence had followed complete removal. They found it impossible to predict the effect of irradiation in any given case. In some of the most advanced cases, in which there were large abdominal and pelvic masses, the response had been remarkably good even to small doses; in others, less advanced, the condition had not been appreciably affected even by enormous doses. They advise removal of the primary growth when possible even in the presence of peritoneal transplants, since subsequent irradiation then offers a fair prospect of temporary relief of symptoms, particularly of pain and ascites. In several cases in which the growth was not completely removed or it recurred, Döderlein has been able to arrest the further growth of the tumor and even to cause its disappearance by irradiation. He believes that although the mode of action and degree of efficacy of irradiation are still uncertain, it is a sin of omission to neglect to use it after complete or incomplete operation for ovarian carcinoma.

#### REVIEW OF CASES

In my study I have attempted to correlate with the late results, the type of carcinoma, the extent of involvement at the time of operation, the nature of the operation and the mode of postoperative irradiation.

Of the fifty-nine cases, there were twenty-nine of unilateral and eighteen of bilateral carcinoma, eleven of abdominal carcinomatosis originating in an ovarian growth, and one of recurrent ovarian carcinoma.

Of the unilateral lesions, eight were solid carcinomas, eight intracystic and eight intracystic and extra-cystic papillary carcinomatous cystadenomas, two adenocarcinomas, and three carcinomas unclassified because of degenerative change. The growth was adherent to the sigmoid and ileum in eight cases, had involved the fallopian tube in four cases and the uterus in eight. Visible residual malignant tissue or implantations remained at the time of operation in seven cases. Unilateral salpingo-oophorectomy was performed in five cases, bilateral salpingo-oophorectomy in five, panhysterectomy in seventeen, and the uterus and one tube and ovary were removed in two.

Postoperative irradiation for three patients in this group was applied by means of vaginal packs of radium in doses of from 700 to 2100 milligram hours. Two of the three patients are alive five years after treatment; one had a solid carcinoma for which panhysterectomy was performed, the other intra cystic carcinomatous cystadenoma for which bilateral salpingo-oophorectomy was performed. The third patient, who at operation was found to have a solid carcinoma attached to the sigmoid, died after five months with extensive carcinoma. In fourteen cases radium packs in the vagina were combined with roentgen rays produced at moderate voltage tension (135 peak kilovolts) and applied usually so as to cross-fire the abdomen through four anterior and posterior fields. In several cases, subsequent courses of roentgen rays were given with intervals of one or two months, either at the Mayo Clinic or elsewhere. Eight patients of this group are alive five years or longer after treatment. The lesions in the eight cases include three carcinomatous cystadenomas; one adenocarcinoma which invaded the tube and uterus; one multilocular carcinomatous cystadenoma with solid areas; three solid carcinomas, the first with peritoneal implants, the second, a highly malignant small-cell tumor with metastasis to the mesenteric lymph nodes and invading the ileum and cecum, the third accompanied by annular papillary carcinoma of the uterus. In three of the eight cases the malignant growth had not been completely removed at operation because of extensive invasion. Death has occurred in six cases, in two of solid carcinoma, in three of an unidentified type of carcinoma, and in one of intra cystic and extra cystic carcinomatous cystadenoma.

Treatment by roentgen rays at 200 kilovolt tension was combined with vaginal packs of radium in five cases of unilateral ovarian carcinoma, two of which were not traced beyond a period of three and a half years, respectively. In both of these cases the lesion was of a papillary type, and the patients were well when last heard from. In a third case in which it had been impossible to remove a widespread carcinomatous cystadenoma completely, recurrence did not develop until three years after irradiation; the patient died six months later. In the remaining two cases of this group, one of adenocarcinoma, the other of intra cystic carcinomatous cystadenoma, the tumor was apparently completely removed, but death occurred in three months and eleven months, respectively. Repeated courses of moderate-voltage roentgen rays alone were used in seven cases, all of unilateral tumor of the carcinomatous cystadenomatous type, in one of which surgical removal was incomplete. Three of these patients are well; two have not been traced for more than one and two years, respectively, although from indirect reports the former was alive four years and three months after operation. In one case, in which there was no visible residual malignancy, recurrence appeared within one and a half years after total hysterectomy in spite of continued bimonthly courses of roentgen



rays. Death occurred three years after operation. The remaining patient of the group was free from recurrence for three years after one course of moderate-voltage roentgen rays. The recurrence was treated with high-voltage roentgen rays and radium with temporary improvement; however, death ensued within a few months. When symptoms of recurrence or of renewed activity of residual malignant tissue manifest after a period of latency, further intensive irradiation, in my experience, has seldom been effective. The most favorable responses to high-voltage roentgen rays under such circumstances were in two cases in which pain was relieved for one year. One of these cases would not have been included in this series except for treatment of recurrent growth in 1923. Left oophorectomy was performed in 1917 for unilateral intracystic and extracystic papillary carcinomatous cystadenoma, followed by treatment with moderate-voltage roentgen rays for a period of two years. Recurrence developed in 1923, exploration was performed, and the tumor was found inoperable. High-voltage roentgen-ray treatment over the pelvis relieved pain and stopped the vaginal discharge for one year, then the patient became steadily worse and no improvement followed subsequent treatment. Death by suicide because of intolerable pain occurred in 1926.

Of the thirty cases in which the lesion was unilateral, including the case just described, four have not been traced within the last year; thirteen (50 per cent) are without evidence of recurrence, four after more than four years, eight after five years, and one patient after six years. In another case inoperable recurrence developed six years after operation. Of the four patients who have not been traced within the last year two were well at the end of three-year and three-and-a-half-year periods. In twelve cases in which the data are available, the symptoms of recurrence or renewed activity of the residual growth appeared in from a few months to six years: in four within the first year, in two during the second, in four in the fourth, in one in the fifth, and in one in the sixth, the average interval before recurrence being two years and five months. The average duration of life after treatment in the same group was two years and nine months. The lesions involving one ovary in the cases in which death had not occurred included four solid carcinomas, two intracystic and five intracystic and extracystic carcinomatous cystadenomas, one adenocarcinoma and one papillary carcinoma with solid areas. Panhysterectomy with removal of one tube and ovary was performed in seven of these cases, bilateral salpingo-oophorectomy in two, and bilateral salpingo-oophorectomy with resection of the ileum in one.

The lesions in eighteen cases of bilateral ovarian carcinoma include fourteen intracystic and extracystic carcinomatous papillary cystadenomas, two solid carcinomas and two adenocarcinomas. The malignant growth had invaded the ileum and sigmoid in two cases, the broad liga-

ment in one case and the uterus in two cases. Peritoneal implants were noted at operation in four cases, and in two others the removal of the growth was reported as incomplete. Panhysterectomy was performed in fourteen cases, and bilateral oophorectomy in four. Nine patients were treated with vaginal packs of radium and with roentgen rays at moderate-voltage tension. Two of these patients are alive, one four years, and the other six years after operation. Roentgen rays alone, usually in repeated courses and often with a combination of rays produced at a moderate and high-voltage tension, were used in six cases. Two patients of this group are alive, one five years and the other seven years after operation. Thus there is a total of four patients with bilateral carcinomatous involvement alive, one each at four, five, six, and seven years after operation. In every case the lesion was of the intra cystic and extra cystic carcinomatous papillary cystadenomatous type, and panhysterectomy was performed. As a rule, the immediate result of irradiation was favorable. Two patients in an advanced stage of the disease remained in excellent health for more than a year; one patient, who died one year after operation, was found at necropsy to be free from recurrence of carcinoma, death having resulted from profuse hemorrhage caused by a gradually enlarging rectovaginal fistula. Because of malignant invasion of the rectovaginal septum, radium needles had been inserted, and were probably a factor in the development of the fistula. In one case in this group the ovarian carcinoma had apparently developed during pregnancy. Massive intrauterine doses of radium given immediately after delivery of the child had checked symptoms for several months. When the patient was first seen at the Mayo Clinic one year later, the growth was widespread with peritoneal and omental implants and a necrotic sloughing mass at the surface. The left tube and ovary were removed and palliative irradiation given, but entirely without effect. The patient died six months later. The average duration of life after treatment for the thirteen patients of this group who have succumbed was one year and eight months: eight died within one year, two in the second year and four in the fourth.

Exploration was performed in nine of the eleven cases of advanced ovarian carcinoma and a specimen removed for pathologic examination. The growth in each case was found to involve the omentum, intestines, and parietal peritoneum. In one case metastasis to the liver was present. Exploration was omitted in two cases, the diagnosis being based on the history and clinical data. Treatment in this group was usually instituted at greatly reduced dosage, since the patients are usually cachectic and unable to tolerate intensive irradiation. In a few instances, treatment given largely as a placebo resulted in improvement in the patient's condition which permitted more intensive irradiation to be given later. One patient so treated survived for four years, and

was in excellent health until a few months before death. A second patient improved for two years; then operation was performed elsewhere, and she died soon afterward. Six patients died within six months after treatment which apparently was ineffectual; one patient lived eight months and for the first six months after treatment was relieved of ascites. One patient died eleven months later having had only slight relief of symptoms. Experience at the clinic with this type of disease has proved that only carefully graded treatment should be administered.

#### SUMMARY AND CONCLUSIONS

1. Of the fifty-nine patients with ovarian carcinoma treated by irradiation at the Mayo Clinic from January, 1920, to January, 1924, eighteen survived for from four to seven years, seventeen being alive at present. Four of the fifty-nine patients could not be traced beyond a three-year period.

2. Although this group is too small to use as a basis of percentages of continued cures, the number of patients alive between four and seven years after operation compares favorably with the number mentioned in available reports of the results of surgical procedures alone.

3. The advanced cases and those in which the growth was not removed completely at operation in the group of continued cures apparently indicates that irradiation has been a factor in the result. The longer average interval of freedom from recurrence obtained in the present series in comparison with the early recurrence noted in other series may perhaps be attributed to postoperative irradiation.

4. Considerable palliation may result even in far advanced cases from the judicious use of radium and roentgen rays.

5. Repeated moderate irradiation, or carefully graded doses for cachectic patients have given superior results, at the Mayo Clinic, to those of more intensive irradiation.

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## REBELLIOUS CERVICITIS FROM CYSTS HIGH IN THE CANAL\*

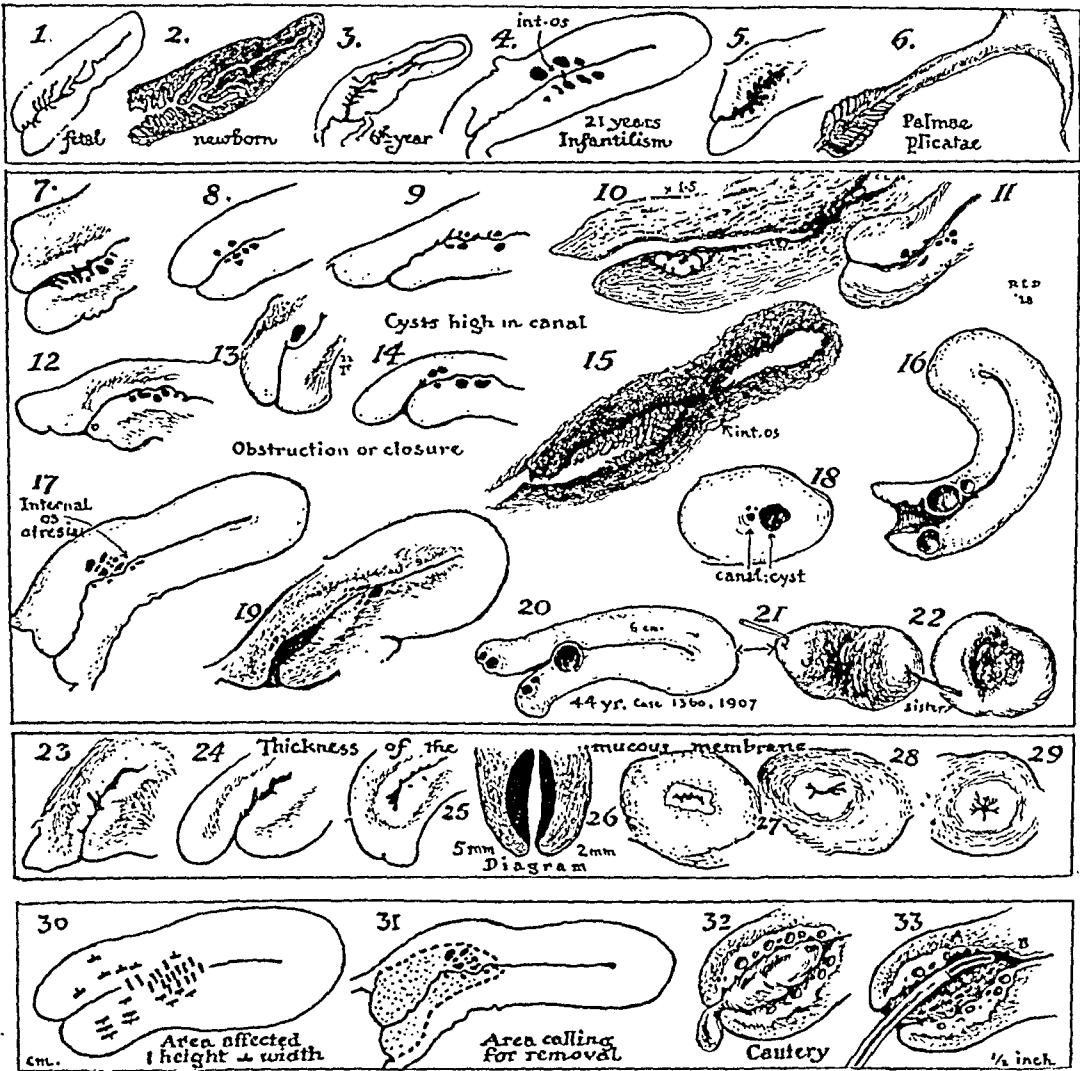
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(From the Committee on Maternal Health)

THE commonest pelvic disorder of women calls for new study, because of its important bearing on sterility and chronic leucorrhea. Gonorrhœa, the one venereal disease now labeled in its obstinate form as "incurable," finds a favorite retreat in woman as an endocervicitis. One possible explanation of resistance to cure is a form of inaccessibility, the significance of which, as far as I know, has not heretofore been fully developed. This is a seat high up in the canal of the cervix. Attention was first drawn to the spot in the days when I developed a small cutting curette (from Delatours' fistula curette with a loop smaller than Craig's) to test and break up the thickened and cystic mucous membrane in the canal. Its importance was emphasized as one began in 1907 to follow canal infections farther and farther up with the electric cautery (Fig. 33). Even before this, high cysts were occasionally determined, in the times when one obtained good results in dysmenorrhœa from regular office dilatation. In such a case, although the canal had been carefully wiped out and then iodine used, the dilator brought a gush of fluid which was thought to have been due to the bursting of a cyst or cysts well out of sight.

In a recent review of the literature showing many sections of the uterus I have noted a rather surprising frequency of cysts below, or at, or just above the internal orifice. In that much neglected art gallery called *Winckel's Pathologie der Weiblichen Sexualorgane*, at least a third of the uteri of active sex life show cysts high in the canal (Figs. 7, 8, 9, 12, 13, 14, 17). Hart's *Atlas* exhibits an atresia evidently due to a group of cysts (17). The Sellheim atlases yield the same surprises (4 and 18), and the Anatomy of Henle pictures as normal a section of the uterus (19) which shows cysts at and above the internal orifice of the cervical canal. Indeed, cysts above this level show in at least three of the sections here presented.

\*Read before the New York Obstetrical Society, November 8, 1927.



## LEGENDS FOR ILLUSTRATION

**Rebellious Cervicitis** (1) At forty weeks of fetal life, the long cervix shows deep folds in mucous membrane (Winckel). (2) A newborn uterus shows even deeper folds (Christeller). (3) These crypts may remain at sixth year (Christeller). (4) In a nullipara of twenty-one with infantilisim, this full-length uterus exhibits cysts at and above external os (Sellheim, 1). See also 19. (5) Deep crypts in nullipara (Sellheim, 1903). (6) Symmetric palmae plicatae, cast of lining from nullipara of forty-two (Guyon). Figs. 7 to 22, Cysts high in canal, with none on vaginal surface except in 12, 20, 21, 22 (the only exceptions in twenty-five sections showing high cysts). Nos. 7, 8, 9, 12, 13, 14 are from Winckel; 11 from Christeller; 18 from Sellheim. The sound could not pass in many of these cases, as in 13, 17, 18 and 20; (10) Complete closure of internal os with cysts, in prolapse at sixty-nine, with chronic cervix catarrh (Christeller). (15) Senile cervicitis, retention cysts at seventy-five (Christeller). (16), (20), (21), (22) Diagrams from living uteri show cysts larger and more tense than sections from shrunken museum specimens (Dickinson). (17) Atresia at internal os from cysts in multipara (Hart.) (19) Cysts above internal os in anatomist's picture of normal uterus (Henle). (20) Section view of cysts exposed by tenaculum in 21, and in 22 similar condition in sister, both cured by cautery. Figs. 23 to 29, Evidence bearing on thickness of lining of canal to show depth of excision or cautery-roast required (drawn from Sellheim, 1900, and Winckel). Compare with 5, 7, 11, 12, 19. Five mm. is a frequent finding and 2 mm. next most common, 26. (30) Measurements from seventeen sections, showing distance of location of cysts above internal os and breadth of area affected. (31) The very large bulk or cylinder of tissue which operation would have to remove if all affected area were included, using 17 as an example. The vaginal cuff of a Sturmdorf operation would have to be very large. (32) Diseased area with narrow external os, and mucous distention of canal typical of this type of cystic trouble. (33) Nasal cautery, after dilatation, burns two strips. From A to B the cysts have been opened and radiated heat has sterilized at least 3 mm. beyond the contacts. The dotted line shows the next strip to be cauterized.

In looking over these sections attention should be paid to the marked thickness of the mucous membrane in the upper canal. This runs from 2 to 6 mm., 5 mm. being a not infrequent figure (26).

A further peculiarity of the chronically inflamed lining is the surface which gives through the curette a feeling of rough, tough gristle, as if the fingernail were scraped across the back of brussels carpet or linoleum. Such a surface is shown in Figs. 5 and 7, and is not merely due to *palmae plicatae*, as in 6.

These findings have an important bearing on the choice of curative treatment or operation. If amputation or coning is in question, it is to be observed that a very thick-tipped cone would be required to eradicate the diseased areas (Fig. 31). In some of the pictured sections such removal would involve bringing away something like a third of the bulk of the uterus, which would so maim the canal as to threaten its function and dilatability in labor.

Why not obliterate the offending cysts and infection instead of sacrificing structure? At least, if future childbearing is in question there is no excuse for such sacrifice, provided the hot platinum wire can properly open up and sterilize these areas. Such effective cautery action has been applied to a considerable number of these cases over a period of twenty years in the manner shown in Fig. 33. Beginning at the internal orifice, a gutter is burned through or nearly through the estimated thickness of the diseased lining and carried down toward the external orifice. A second groove is laid on the opposite side. If the canal is the size of the little finger, three lines are occasionally made in a first treatment, but I usually restrict myself to two because in a number of cases the extent of the radiation of the heat has reached a sufficient area. Three weeks later, in case mucopurulent secretion is still free or the sound finds rough areas in a relatively large canal, one or two lines are laid down on surfaces not previously attacked.

The most obstinate cases I have had, those requiring more than three cautery treatments, have been persistent infections of the upper part of the canal. Obviously, however, the clinical demonstration as to the level whence glairy mucus or mucopus makes its exit will only be demonstrable if one uses a tubular hysteroscope. This will be worth doing in obstinate cases, to search for cysts up the canal. An endoscope has a better field in the cervix than in the uterine cavity because there is less bleeding in this lower portion.

I am still watching for stenosis produced by the conservative, step-by-step procedure thus outlined, as part of ordinary office treatment. So far, no case needing subsequent dilatation has been detected in my series or that of Dr. Cary, even where relapse after months or years has called for repetition of cautery application.

NOTE: Since this paper was presented, A. H. Curtis has informed me verbally that he abandoned the use of radium within the cervix for the treatment of cervicitis early in 1925 or thereabouts, because of an occasional stricture and disturbance of menstruation even with small dosage. He has seen narrowing of the external os from the use of the cautery, but could not state whether this was due to the Post cautery. I ceased using the latter because the shank grows so hot as sometimes to cause a circular burn of the external os, where localized action up the canal is the only cauterization desired. Operators in San Francisco and Los Angeles have seen this burning at the os from the Post cautery, with need of dilatation later, as reported to me verbally in March, 1928. Cumberbatch, Corbus and others call for thirty to forty minute treatments once a week or oftener for weeks, which is to be contrasted with the few seconds of the cautery application. Hyams, after trying diathermy on thirty patients, reports that the sterilization action is not deep nor wide enough for effective work. The Filhos chemical cautery causes a cylindrical complete slough of the entire mucous membrane down to the musculature. Such action means closure of the canal in some instances. Therefore, if radium is found to reach too deeply and to affect the ovaries sometimes, and diathermy to act too slowly or superficially, we may again urge acquiring expertness with the simple hot wire.

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# RELATION BETWEEN STRUCTURE AND PROGNOSIS IN CERVICAL CARCINOMA UNDER RADIATION TREATMENT\*

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IT IS the purpose of this study to determine the relative value of histologic structure in the prognosis of cervical carcinoma, to observe the relation between histologic structure and response to radiation and to determine the extent to which the cell type may serve as a guide to treatment. The essential criteria for a study of this type are: (1) A sufficient number of cases to permit of accurate statistical deductions; (2) a group of cases which have been observed over a sufficient period to permit of judgment as to cure; (3) satisfactory biopsy material for histologic study and classification; (4) a uniform method of treatment applied to all cases; (5) a knowledge of the clinical extent of the disease at the time the treatment was begun, in order to evaluate properly this important factor in prognosis.

In our study all of these criteria are fulfilled. The material at our disposal consists of two hundred cases† of unmistakable carcinoma of the cervix treated in 1922 and 1923 whose present condition is known and from whom satisfactory tissue is available for microscopic study. Special emphasis is placed upon the fact that all the cases have been treated by radiation alone, the technic of which, with few exceptions, has been fairly uniform as to type and amount.

## CLINICAL CLASSIFICATION

A classification of the cases into three clinical groups based upon the gross extent of the disease has been made, as follows:

1. *The Early Group*.—Composed of cases in which the disease is localized and confined to the cervix.

2. *The Borderline Group*.—Composed of cases in which the disease is more advanced, involving the paracervical tissues, or adjoining vaginal fornices, with slight fixation of the cervix, the uterus remaining freely movable and the parametrium uninvolved.

3. *The Advanced Group*.—Comprising those cases in which the disease has extended beyond the uterus and into the parametrium, resulting in more or less fixation of the uterus.

\*Read at a meeting of the New York Obstetrical Society, December 15, 1927.

†The four-year cases have been included in order to make the analysis more accurate statistically by increasing the number of cases. The percentage of recurrences during the fifth year in patients who had been free of disease for four years is so small as to be negligible. The word cure is therefore qualified to mean freedom from disease four and five years.



## TREATMENT\*

The plan of treatment carried out has consisted in the application of radium in rather massive doses at the site of the primary lesion by means of buried emanation, vaginal applicators, and intracervical and uterine capsules. This has been combined with the use of x-rays. At the time the patients referred to in this paper were treated, low-voltage x-rays were employed. The circumference of the pelvis was divided into four quadrants, and one treatment was given to each quadrant, the tube being so placed as to be centered on the cervical lesion. This technic has been modified recently by the substitution of gold filtered seeds for the glass seeds and high-voltage x-rays for low voltage.

## HISTOLOGIC CLASSIFICATION

The basis of classification which has been adopted is the *degree of anaplasia* of the tumor. The significant histologic signs of anaplasia are cellularity, variation in size and shape of nuclei, nuclear hyperchromatism, infiltrative tendencies, number and atypical quality of mitoses, loss of polarity, and absence of adult differentiated characters. A microscopic study of the biopsy material based upon these features demonstrated three fairly distinct groups. At one extreme there is a small group in which the tumor cells are highly differentiated, adult in character, with definite squamous tendencies, hornification and occasional pearl formation (Adult type, Grade I). At the other extreme there is a small though larger group in which the cells show complete loss of differentiation, absence of squamous characters, atypical qualities, and diffuse infiltrative growth with numerous atypical mitoses. The cells are small and round, or spindle in form, and the nucleus is markedly hyperchromatic (Anaplastic type, Grade III). Between these two extremes there is a larger intermediate group showing only partial differentiation and moderate anaplasia. In this group squamous characters are either slight or more often absent. The growth may be atypical, but lacks diffuse infiltration. There is a partial loss of polarity. These cells are large and frequently show a plexiform arrangement (Plexiform type, Grade II). This classification coincides in general with those of Schottlaender and Kermauner,<sup>3</sup> Regaud, Martzloff<sup>4</sup> and Broders.<sup>6</sup>

It is, of course, impossible to draw a sharp line of division between the three histologic groups. In a small proportion of cases it has been somewhat difficult to decide whether a tumor belonged to the plexiform or anaplastic group. Tumors presenting this structure, however, are distinctly radiosensitive and consequently are classified as anaplastic. The differentiation between the adult and anaplastic forms

\*For a more detailed description of the treatment employed in these cases the reader is referred to references 1 and 19 in the bibliography.

has presented no difficulties and the presence or absence of squamous characters has served as a good basis for division between the adult and plexiform types. Table I shows the relative frequency of the different histologic grades as compared with Martzloff's<sup>4</sup> classification.

As indicated in Table I, the majority of the tumors belong to the intermediate or plexiform group, whereas the smaller groups comprise the adult and anaplastic types of cell. Forty-two out of two hundred cases, or 21 per cent, belong to the highly undifferentiated anaplastic cell type. It is significant that one in five cases of this series is a very cellular, malignant and anaplastic tumor and consequently highly susceptible to radiation.

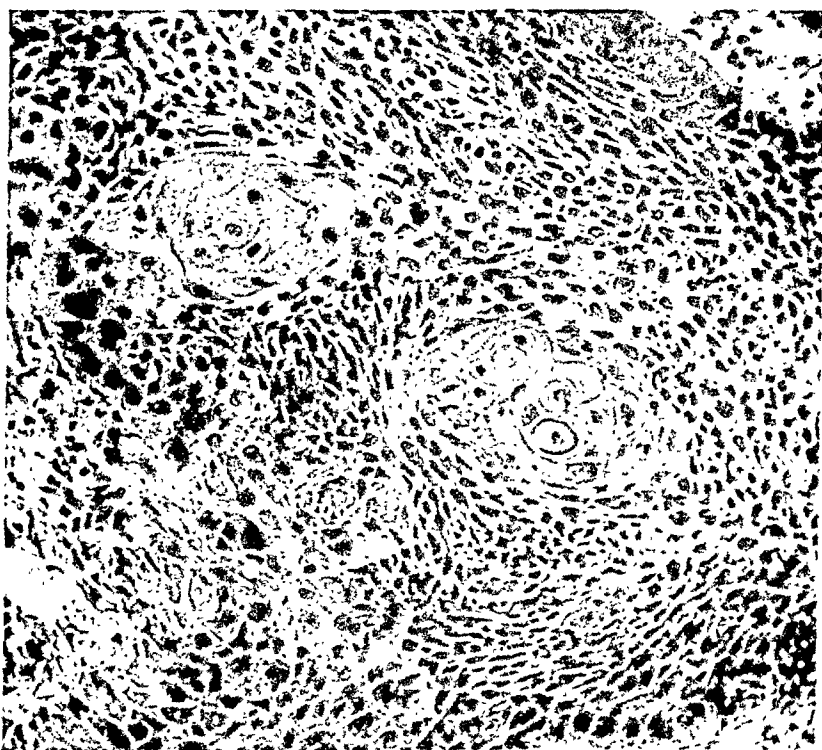


Fig. 1.—Photomicrograph showing epidermoid carcinoma of cervix. This is the adult highly differentiated type with definite squamous characters (Grade I, radioreistant)

In order to study the relationship between histologic structure and prognosis, the distribution of the cell types among fifty cured cases is compared to their general distribution in the entire series, as shown in Table II.

TABLE I. SHOWING INCIDENCE OF STRUCTURAL TYPES AS COMPARED WITH MARTZLOFF'S THREE GROUPS

CELL TYPE WRITERS' CLASSIFICATION	NO. CASES	PER CENT	CELL TYPE MARTZLOFF'S CLASSIFICATION	NO. CASES	PER CENT
Adult (I)	35	17	Spinal	30	22
Plexiform (II)	123	62	Transitional	90	66
Anaplastic (III)	42	21	Spindle	17	12

TABLE II. SHOWING THE DISTRIBUTION OF STRUCTURAL TYPES IN FIFTY CURED CASES OF CARCINOMA OF CERVIX

CELL TYPE	NO. CASES	PER CENT	PERCENTAGE IN TOTAL SERIES
Adult	6	12	17
Plexiform	24	48	62
Anaplastic	20	40	21

It may be seen that there is a distinct increase of the anaplastic type of cell in the cured group over the percentage in the entire series (40 per cent as compared with 21 per cent). This would seem to

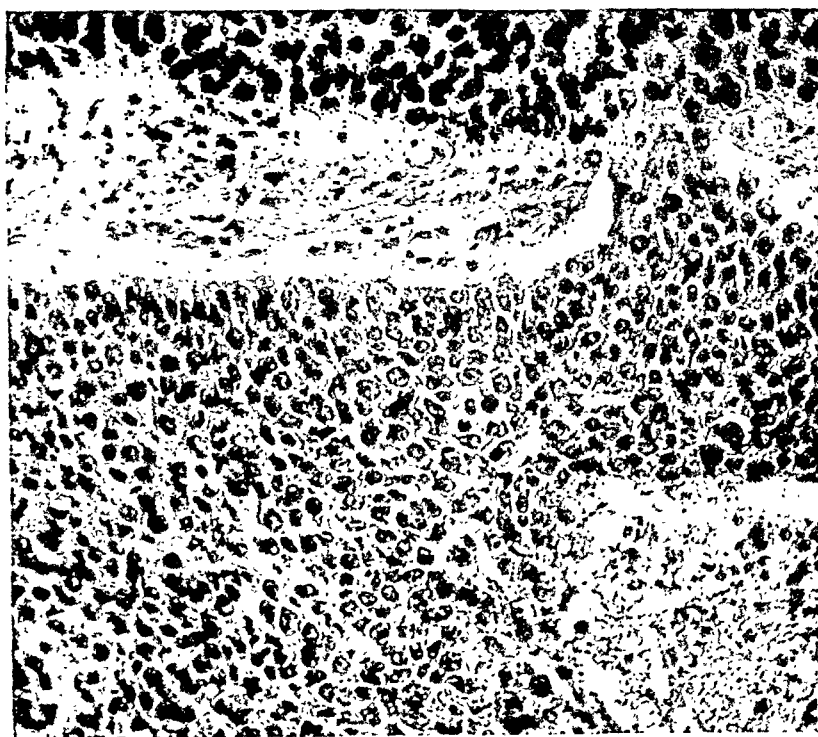


Fig. 2.—Photomicrograph showing plexiform epidermoid carcinoma of cervix. The structure is cellular and partly undifferentiated. Squamous characters are absent. (Grade II.)

indicate a decidedly better prognosis in the anaplastic type than in either of the other cell types.

There were twenty cases in which death occurred in spite of the early or borderline stage of the disease. In this group in which the clinical setting was favorable and the treatment similar to that generally employed, it seems logical to search for a cause for the unexpected result in the histologic structure. Table III shows the distribution of cell type in this group of cases.

Table III shows an incidence of 60 per cent in the intermediate or plexiform type, which is approximately the normal incidence of this type of cell. There is a slight decrease in the anaplastic type and increase in the adult type over the normal incidence. This comparison,

TABLE III. SHOWING DISTRIBUTION OF STRUCTURAL TYPES AMONG TWENTY FAILURES IN THE CLINICALLY EARLY AND BORDERLINE GROUPS

CELL TYPE	NO. CASES	PERCENTAGE IN 20 EARLY AND BORDERLINE FAILURES	PERCENTAGE IN TOTAL SERIES
Adult	5	25	17
Plexiform	12	60	62
Anaplastic	3	15	21

therefore, fails to show any definite relationship between the cell type and the result, and the deduction must be made that other factors which have not been recognized are responsible for these failures.

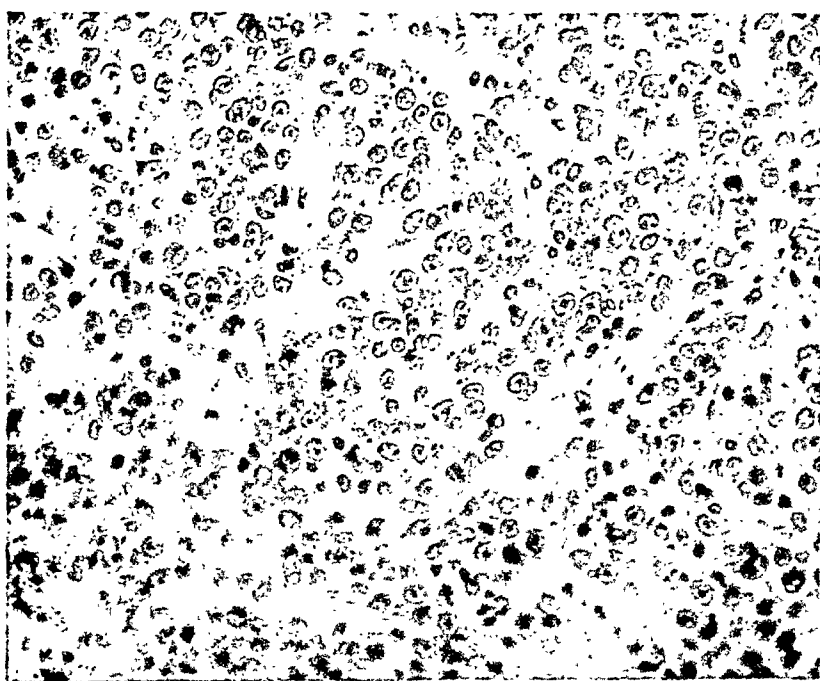


Fig. 3.—Highly cellular and anaplastic epidermoid carcinoma of cervix. The cells are small and atypical. There are numerous mitoses. The growth is diffuse and infiltrating. (Grade III, highly radiosensitive.)

TABLE IV. SHOWING DISTRIBUTION OF CELL TYPES AMONG 130 ADVANCED CASES WHICH FAILED TO SURVIVE

CELL TYPE	NO. CASES	PER CENT	PERCENTAGE IN TOTAL SERIES
Adult	24	18	17
Plexiform	87	67	62
Anaplastic	19	15	21

It is significant that only nineteen cases, or 15 per cent, belong to the anaplastic group as compared with an incidence of 21 per cent in the general group. The highly malignant type, therefore, fails to show a preponderance in this unfavorable group of cases; in fact the incidence is somewhat smaller.

A striking group of cases is that in which the disease was well advanced clinically, with fixation of the uterus and extensive para-

metrial involvement, yet in spite of these most unfavorable factors the patients were cured of the disease. Analysis of the treatment employed in this group of cases shows it to be essentially similar to that employed in the general group. It is of interest to note the distribution of cell type in this group, in order to determine whether the unexpected result may be explained on the basis of a special susceptibility to radiation. Table V shows the distribution of the three cell types in this group of cases.

It is interesting to note that in fourteen out of thirty cures of advanced carcinoma of the cervix, the histologic structure was of the

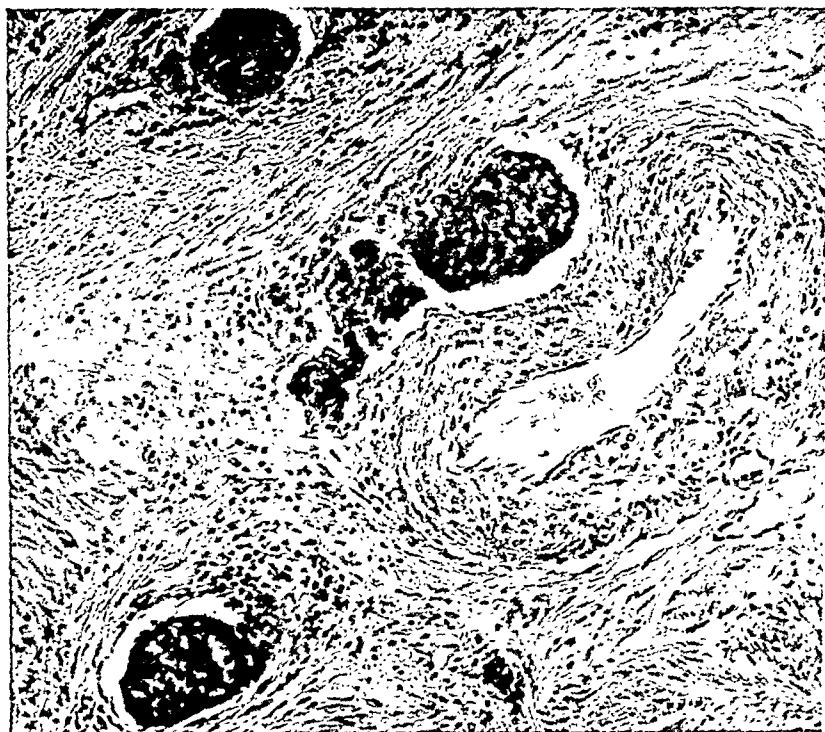


Fig. 4.—Very malignant and anaplastic carcinoma of cervix infiltrating wall of uterus and growing in perivascular lymphatics (Same case as Fig. 3.) The patient died soon after hysterectomy with widespread metastases.

TABLE V. SHOWING THE DISTRIBUTION OF STRUCTURAL TYPE AMONG 30 CASES OF ADVANCED CARCINOMA OF THE CERVIX WELL FOUR AND FIVE YEARS

CELL TYPE	NUMBER OF CASES
Adult	1
Plexiform	15
Anaplastic	14

most cellular and malignant type. This finding is of particular importance since it coincides with the theoretic principles involved and demonstrates the important fact that the radiosensitivity of the tumor expresses itself not only as a primary regression, but, with adequate radiation, as an ultimate cure in spite of the clinically advanced stage of the disease.

In order to further study the relationship between histologic structure and prognosis, the cases were divided into two groups, according to the clinical stage of the disease, as follows: (a) Early and borderline, and (b) advanced, and the percentage of cures in each group studied in relation to the histologic grade, as shown in Table VI.

TABLE VI. SHOWING PERCENTAGE OF CURES IN RELATION TO THE CLINICAL STAGE OF THE DISEASE AND THE HISTOLOGIC TYPE UNDER RADIATION AND SURGICAL TREATMENT, RESPECTIVELY

CELL TYPE	RADIATION				SURGERY	
	STAGE OF DISEASE	TOTAL NO. CASES	NO. WELL	PER CENT CURED	PER CENT OF OPERATIVE CURES, J.H.H. MARTZLOFF	PER CENT OF OPERATIVE CURES, MAYO CLINIC, BRODERS
Adult (Grade I)	Early and Borderline	10	5	50	47	53
	Advanced	25	1	4		
Plexiform (Grade II)	Early and Borderline	21	9	43	24	21
	Advanced	102	15	14		
Anaplastic (Grade III)	Early and Borderline	9	6	66	9½	9½
	Advanced	33	14	42		

Analysis of Table VI shows the relative effects of the clinical stage of the disease and the histologic cell type upon the prognosis. It is at once evident that the stage of the disease alone is a most important factor in prognosis. The cures effected in the early and borderline stage of the disease are comparatively high regardless of the cell type. The early and borderline cases have been grouped together in order to isolate the distinctly advanced cases as a test group. *The crucial test of the relative importance of the histologic type is to control the stage of the disease by studying prognosis in a group of advanced cases in which an unfavorable outcome is expected.* Results of the examination of the figures from this standpoint, comparing the percentage of cures in the three cell types of advanced cases, are shown in Table VII.

TABLE VII. SHOWING RELATION BETWEEN PROGNOSIS AND STRUCTURAL TYPE IN ADVANCED CASES OF CARCINOMA OF THE CERVIX TREATED BY RADIATION

CELL TYPE	NO. CASES	CASES WELL	PER CENT CURED
Adult	25	1	4
Plexiform (II)	102	15	14
Anaplastic (III)	33	14	42

It is quite evident from these figures that the prognosis in advanced cancer of the cervix under radiation therapy is extremely poor in the adult type and unexpectedly favorable in the anaplastic type. Only one case of the adult type out of twenty-five advanced cases, or 4 per cent, is cured as compared with 42 per cent cures in advanced carcinoma of the cervix of the anaplastic type. This result is especially

significant when it is considered that the total percentage of cures including early and borderline cases is only 25 per cent and the cures in the advanced cases in all histologic types 19 per cent.

The conclusion seems justified that in the advanced stage of the disease the prognosis improves with the degree of anaplasia when radiation is the therapeutic agent employed. The reason for this relation is obvious when the greater radiosensitivity of the more cellular and anaplastic tumor is taken into account.

The important rôle played by the stage of the disease in prognosis is well recognized. When the entire series of cases is divided into the three clinical groups defined above and compared with the results, Table VIII is obtained.

TABLE VIII. SHOWING THE EFFECT OF THE CLINICAL STAGE OF THE DISEASE UPON PROGNOSIS

CLINICAL STAGE	NO. CASES	DEAD	ALIVE	PER CENT CURED
Advanced	160	130	30	19
Borderline	21	15	6	29
Early	19	5	14	74

The result of this comparison indicates the prognostic importance of the clinical stage of the disease. On the other hand, it is significant that as many as 19 per cent of the advanced group are well, whereas the total percentage of cures for all groups and stages of the disease is only 25 per cent. It is important in this connection to recall that 21 per cent of the entire series belong to the radiosensitive group. These figures are strikingly close. It may be stated generally that one in five cases of carcinoma of the cervix is highly radiosensitive, and that one in five cases is curable by radiation in the advanced stage of the disease.

#### RELATION BETWEEN AGE AND PROGNOSIS

Table IX is designed to show the relationship between age and prognosis. The cases in each age group are further subdivided into the three clinical stages of the disease in order to control this factor in prognosis.

It may be seen from Table IX that all the patients under thirty years of age failed to survive. It cannot be inferred from this, however, that the grave prognosis in this small group of cases is due to the age factor alone. It should be noted that five of the six patients were in the advanced stage of the disease and the sixth was a borderline case. The histologic structure in this group showed Grade I in two cases and Grade II in four cases. The higher percentage of cures in the 30 to 40 age group may be accounted for by the accidental distribution of cases (14 of the thirty were early and borderline). In

TABLE IX. SHOWING RELATION BETWEEN AGE AND PROGNOSIS IN CARCINOMA OF THE CERVIX

AGE	NO. CASES	PER CENT	STAGE OF DISEASE	NO. OF CASES IN EACH CLINICAL GROUP	PER CENT CURED IN EACH CLINICAL GROUP	AVERAGE PER CENT CURED IN EACH AGE GROUP
20-30	6	3	Early	0	-	0
			Borderline	1	0	
			Advanced	5	0	
30-40	30	15	Early	7	86	47
			Borderline	7	57	
			Advanced	16	25	
40-50	73	36	Early	6	67	28
			Borderline	11	36	
			Advanced	56	21	
50-60	56	28	Early	6	66	23
			Borderline	6	33	
			Advanced	44	16	
60-70	34	17	Early	0	-	21
			Borderline	6	33	
			Advanced	28	18	
70-80	1	0.5	Early	0	-	0
			Borderline	1	0	
			Advanced	0	-	

the remainder of the age groups the percentage of cures is about equal. From this comparison it would seem that there is no definite relationship between age and prognosis with the possible exception of patients under thirty years of age. It is possible that in this group the prognosis is worse, although our data fails to demonstrate definitely this relation.

#### DISCUSSION

The problem of histologic prognosis dates back to Hansemann,<sup>7</sup> who introduced the term anaplasia. He believed that a direct relationship existed between anaplasia and degree of malignancy. Ewing agrees with Hansemann in this belief and utilizes the histologic signs of anaplasia as an estimate of the degree of malignancy. Schottlaender and Kermauner were among the first to divide epidermoid carcinoma of the cervix into three histologic grades and applied to them the terms mature, half mature and immature. This division is based upon the degree of anaplasia of the tumor. Broders' classification of tumors is also based primarily upon the conception of cell differentiation. Martzloff's classification of cervical carcinoma into spinal, transitional, and spindle-cell types is based upon the same fundamental conception of loss of differentiation or anaplasia. In his classification the spinal cell is the most highly differentiated and the spindle the least differentiated, whereas the transitional cell occupies an intermediate position. Using this grouping Martzloff found that when surgery is employed the prognosis was best in the spinal cell and worst in the spindle-cell type. Pemberton,<sup>8</sup> using Martzloff's classification, concludes that the order of malignancy of the different cell types progressing from least to worst is spinal, transitional and spindle, thus agreeing with Martzloff. Kimbrough and Norris<sup>9</sup> conclude that the spindle cell type appears to be the most malignant, but believes that the stage of the disease at which treatment is instituted is the greatest prognostic factor in carcinoma of the cervix and is more important than the histologic type. These authors find a similar prognosis in tumors of least and highest malignancy and attribute this result to



the balancing of the two factors, malignancy and radiosensitivity. Regaud<sup>10</sup> recognizes three histologic types of epidermoid carcinoma of the cervix and regards them of some prognostic value, although the therapeutic measures are not varied according to cell type. Schmitz<sup>11</sup> and his associates have endeavored to utilize histologic factors in prognosis and treatment of carcinoma of the cervix. Wintz,<sup>12</sup> states that the differentiation between immature, half mature, and fully mature carcinoma, has not, in his opinion, offered any practical results for either prognosis or treatment, and Plaut<sup>14</sup> concludes that there is no reliable basis for histologic prognosis in cervical carcinoma.

The advent of radiation as a therapeutic agent in the treatment of cervical carcinoma lends a special significance to histologic prognosis. It should be emphasized that in a study of relation between structure and prognosis the therapeutic agent employed is a factor of prime importance. The varying degrees of malignancy described by Broders and later by Martzloff are based upon studies in which surgery was the treatment employed. These results state essentially that the prognosis is best in the most differentiated and adult tumors and worst in the very cellular, undifferentiated and anaplastic tumors. When radiation is used instead of surgery we find that this relationship is completely altered by the fact that the more cellular and undifferentiated tumors are the more radiosensitive and consequently offer a better prognosis.

*The close relationship between clinical course, susceptibility to radiation and histologic structure found in this study coincides with a similar relationship observed in tumors in other locations.* A distinct clinical, pathologic, and radiologic entity is encountered in so-called transitional cell carcinoma of the base of the tongue, tonsil, and nasopharynx.<sup>16</sup> The essential feature of this disease is the radiosensitivity of a group of anaplastic epithelial tumors found in these particular regions. Operative removal of the primary lesion, or metastatic nodes, results invariably in local recurrence and wide dissemination of the disease, whereas their response to radiation is phenomenal. An analogous situation is found in the operative removal of a highly cellular anaplastic carcinoma of the cervix. When rapid local recurrence and distant metastasis follow hysterectomy in an apparently favorable case, the cell type is usually of the anaplastic variety (Grade III), and consequently is especially amenable to radiation instead of surgery.

Although the results of surgery in the treatment of malignant disease are dependent upon numerous factors, it is a well recognized fact that the degree of malignancy of the tumor is one of the most important determining factors. The best results are obtained in the most adult and differentiated type, whereas the worst results occur in the surgical treatment of the very malignant cellular tumors. Thus Martzloff quotes the following statistics from the Mayo Clinic and the Johns Hopkins Hospital.

TABLE X. PERCENTAGE INCIDENCE OF FIVE-YEAR CURES FOR THE DIFFERENT TYPES OF EPIDERMOID CARCINOMA OF THE CERVIX UTERI

	SPINDLE-CELL CANCER GRADE II OF BRODERS	TRANSITIONAL CELL CANCER GRADE III OF BRODERS	SPINAL-CELL CANCER GRADE IV OF BRODERS
The Johns Hopkins Hospital (Martzloff) (surgery)	47%	24%	9%
The Mayo Clinic (Broders) (Surgery)	53%	21%	9%
Memorial Hospital (radiation)	50%	43%	42.66%

The striking feature of this table is the very low percentage of cures in the spindle-cell group (9½ per cent). This is the cell type which is highly radiosensitive and in which our radiation results indicate 42 per cent cures, including the very advanced cases.

Since the advent of radiation, the problem of histologic prognosis has become somewhat confused. This confusion is due largely to the failure to recognize the fundamental biologic law, that the most cellular and most malignant tumors are at the same time the most radiosensitive. This brings about an apparently paradoxical situation in which the most malignant tumors should offer the best prognosis when radiation is employed. In view of the fact that the most malignant tumors offer the worst prognosis with surgery and the best with radiation, a comparison of two series of cases in which the therapeutic agents have not been considered is misleading. Another matter of confusion has been the use of the term "malignancy" in relation to radiation. Because of their radiosensitivity, the question has been raised as to whether the cellular and anaplastic tumors are, therefore, not less malignant. If this attitude is adopted, the degree of malignancy of a tumor must vary according to the therapeutic agent employed. It seems to the authors more sound to regard the degree of malignancy of a tumor as an intrinsic biologic property of the tumor and independent of external influences. Surgery and radiation are external agents and may affect the clinical course of the disease and alter the prognosis, but the degree of malignancy as a potential factor remains unchanged. It might be well to adopt Ewing's distinction between potential malignancy and clinical malignancy. From this viewpoint the former is a constant factor, whereas the latter varies and depends upon the therapeutic method employed.

The results of this study indicate a direct relationship between degree of radiosensitivity and percentage of cures. The results coincide with the theoretic principle involved. The low degree of malignancy of the adult and highly differentiated type of tumor is accompanied by a good prognosis only when the disease is in its early stages. These cures are effected by the caustic effect of a large dose of radiation upon an early lesion, so that the limited disease is eradicated in spite of

its radioresistance. When, however, this type of growth becomes more advanced and involves the parametrium, its prognosis becomes grave because we have to combat, not only an advanced lesion, but also a radioresistant lesion (see Table VI, 4 per cent "cures").

Examination of the anaplastic group (Grade III) shows a distinctly higher percentage of cures than in the other two groups. The remarkable feature is the high percentage of cures in the advanced cases (42 per cent). This result is attributed to the marked radiosensitivity of the anaplastic type of growth. It would seem, therefore, that the high potential malignancy and advanced stage of the disease are both offset by their marked susceptibility to radiation resulting in a cure in a high percentage of cases. In the intermediate group the tumor is neither highly malignant nor particularly radiosensitive. The lower percentage of cures in this group may be readily explained by the high proportion of advanced cases (83 per cent).

The observations recorded here find support in the studies of other investigators. Thus Martzloff quotes fifteen advanced cases of carcinoma of the cervix in whom the prognosis seemed very poor clinically, but the patients lived for a long time, some under radium treatment. Ten of these cases belonged to the histologically malignant group, consequently they were susceptible to radiation. Plaut finds four cures among nine cases of spindle-cell carcinoma treated by radiation and points out the good prognosis in the most malignant cell type as evidence against the value of histologic prognosis. It is important, however, to recognize that the poor results obtained by Martzloff in this group and the good results of Plaut may be explained by the fact that surgery was the therapeutic agent employed in the former group and radiation in the latter. These are precisely the results to be expected in the treatment of the most malignant type of tumor by surgery and radiation, respectively.

Apparently the same property of instability of the tumor process which renders a tumor more malignant and causes it to grow rapidly and disseminate widely also renders it more susceptible to radiation. The rapidly growing tumors as a rule respond rapidly to radiation and vice versa. Consequently the prognosis must depend upon the biologic response of the tumor to the particular therapeutic agent employed.

From a practical standpoint it is of some importance to be able to predict by histologic study what response to radiation may be expected in any given case. The ability to recognize histologically a group of carcinomas of the cervix which are especially unsuitable for surgery and peculiarly amenable to radiation may help to eliminate many of the unfavorable surgical results and decidedly improve the percentage of surgical cures where this method is still employed. In

the advanced cases this information may serve as a useful guide to radiation therapy.

#### SUMMARY AND CONCLUSIONS

1. The degree of potential malignancy of a given case of carcinoma of the cervix may be determined with reasonable accuracy by a study of the histologic structure. This information may be of considerable value in prognosis and treatment.

2. Epidermoid carcinoma of the cervix may be classified histologically into three grades, based primarily upon the degree of anaplasia. These groups correspond closely to three degrees of potential malignancy as well as to three grades of radiosensitivity (low, medium, and high).

3. The adult type of carcinoma of the cervix (Grade I) is markedly resistant to radiation; the anaplastic type (Grade III) is highly radiosensitive; whereas the plexiform type (Grade II) occupies an intermediate position.

4. The factors which determine prognosis in carcinoma of the cervix, as in other diseases, are multiple and not single. The clinical stage of the disease at which treatment is instituted and the radiosensitivity of the tumor are believed to be the most important factors in prognosis when radiation is employed.

5. Twenty to twenty-five per cent of carcinomas of the cervix are histologically very cellular, malignant, and anaplastic tumors and consequently are highly susceptible to radiation.

6. Under radiation treatment the prognosis of cancer of the cervix improves with the degree of anaplasia of the tumor. This is due to the greater radiosensitivity of the more anaplastic tumors and results in a high percentage of cures in a group in which the surgical results have been especially unfavorable.

7. Radiation therapy of advanced uterine cancer may result in a cure in a relatively high proportion of cases when the tumor is of the radiosensitive type, whereas in the radioresistant type the prognosis is distinctly worse and only a palliative result can be expected.

8. The results of this study confirm the biologic relationship between anaplasia and radiosensitivity and demonstrate the ability to cure advanced disease of the most malignant type by radiation in a high proportion of cases.

In the study of the histologic material from the cases included in this report, the authors are greatly indebted to Dr. James Ewing for much valuable aid and many helpful suggestions.

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(For discussion, see page 125.)

## MIXED TUMORS OF THE CERVIX UTERI, "SARCOMA BOTRYOIDES," WITH A REPORT OF TWO CASES

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THE occurrence of mixed tumors of the cervix is comparatively rare. They are mesodermal in origin and the connective tissue element is usually the most prominent; therefore some cases, very similar to the ones here reported, have been described as sarcomas. These tumors may occur at any age, but for convenience they are divided into two groups: those in children and those in adults. Unlike vaginal mixed tumors, which are most common in infancy, mixed tumors of the cervix are much more common in the late decades. Mixed tumors in the infant are nearly always fairly typical, appearing as polypoid masses resembling a bunch of grapes. Those in adult life are not so constant in appearance. They may be very similar to those just described and may arise from the vaginal surface of the cervix or from the canal, protruding through the cervix. Others are firm and more or less typical of a true sarcoma. Metastases of the latter type frequently have typical botryoid characteristics.

Mixed tumors of the uterus are found mainly in the cervix. Only eleven cases have been described arising from the fundus, excepting the lipomas (simple lipoma, lipomyoma, lipofibroma, or liposarcoma), which occur chiefly in the fundus. There are no statistics available giving the number of reported cases arising from the cervix. It is sometimes very difficult to determine the exact site of origin, and a mistake can easily be made, due to the fact that many occur in children, and it is not easy to make a satisfactory examination of a child's vagina. More have been reported as arising from the vagina than

those having their origin in the cervix. Of the former type, McFarland collected 102 cases.

The clinical picture varies considerably. In the infant the tumor is usually first noticed when it appears at the vulva, although a blood stained discharge may precede the discovery of the tumor. In the adult a foul, blood stained discharge, dyspareunia, or the discovery of a mass in the vagina usually causes them to consult a physician. They may have backache, a feeling of weight in the vagina, and a bearing down pain. Small grape-like bodies are frequently passed and may be confused with a hydatidiform mole. If in a child, the growth is usually thought to be a simple polyp, and excision is advised. It quickly recurs and its malignant nature is then suspected or microscopic study may reveal its true nature. If in an adult, more radical surgery is frequently done. Surgery, however, has done very little more than give temporary relief, because there are no permanent cures on record. This is a clinical fact, proving the extreme malignancy of these tumors. However, the histologic appearance of these tumors does not give the impression of malignancy in every case.

They grow by direct extension involving the bladder or parametrium, but rarely the rectum. Pain on urination follows if the tumor extends into the bladder or cystitis develops from bacterial invasion. The primary or recurrent tumor soon attains large size, and symptoms of urinary obstruction develop. There may be painful defecation due to pressure, rather than to rectal involvement. Metastases, however, may occur in the neighboring lymph and blood vessels and rarely, distant metastases develop.

Several theories have been advanced as to the origin of these tumors. Kolisko and Hauser (as mentioned by Lynch) believe that they arise from fetal rests in accord with Conheim's theory. Wilms (according to Frank) believes that there is a displaced embryonal germ cell pushed down ahead of the wolffian duct. Frank goes on to say that this indifferent germ cell must be a mesodermal cell in order to supply the myotome (striped muscle) and mesenchymal (cartilage, etc.) derivatives.

CASE 1.—A. P. was born September 26, 1924, as the fourth child of normal healthy parents. Delivery was normal in every respect. Oldest sister died from rheumatism and endocarditis. One sister and one brother are living and well. On July 9, 1926, the child was brought to the Lakeside Dispensary and referred to the hospital for removal of a papilloma of the cervix. A few weeks before admission the mother noticed a red mass protruding from the child's vagina. This was easily seen when the child was standing, but in other postures often disappeared. There was no noticeable bleeding or increase in size. In spite of a good appetite, the child had been losing weight, was drowsy in the daytime, and cried during the night. Except for measles and varicella, the past history was negative.

The child at twenty-one and one-half months weighed only 20½ pounds. Upon inspection a moderately firm mottled yellow and grayish red mass was found pro-

truding from the vagina, resembling a cluster of very small grapes. The whole mass was 25 mm. long and 16 by 14 mm. in diameter. It was covered by smooth epithelium, and composed of a stalk, to which were attached the grape-like bodies by short pedicles. Some of the grape-like masses were seemingly cystic and others solid, of variable size, not exceeding 5 mm. in diameter. The tip was firmer than the base, and the polypi there were small.

On introducing an applicator into the vagina, the child cried, and when the child cried the tumor receded into the vagina. Gentle pressure on the abdomen brought about reappearance of the tumor. We were unable to determine the point of attachment of the tumor at that time. The inguinal lymph nodes were enlarged bilaterally, averaging 3 mm. in diameter. To a less extent the glands of the neck and axilla were also enlarged.

On July 10, a polyp was removed for biopsy and the pathologic diagnosis of sarcoma was made. On July 14 the patient was anesthetized. Examination showed the point of attachment to be the cervix. A tonsil snare was placed around the



Fig. 1.—Actual size of the original tumor in Case 1 with a probe through the cervical canal.

tumor and upon the cervix as far as possible and the tumor excised. Examination of the tumor showed that practically the entire cervix had been removed, that it had been amputated 18 mm. above the external os. There was also a smooth surface of peritoneum 8 mm. in diameter on the posterior surface of the upper portion of the excised mass.

The polypoid tumor was, as previously described, attached at its base to the portio and the lower cervix, but no sharp borderline could be made out. One of the swollen inguinal lymph nodes was also removed.

Microscopic sections, made through the grape-like proliferations, showed the free surface covered with a normal squamous epithelium. The tumor tissue began immediately beneath the vaginal epithelium and showed in some regions a slight infiltration with leucocytes.

Spindle cells were predominant, although occasionally a few round cells could be found. The spindle cells differed markedly in different parts of the tumor. In some areas the arrangement of these cells was very dense, of the classical

type of sarcoma, but there were other areas with loose myxomatous tissue, poor in cells.

The whole tumor was very rich in blood vessels, especially in thin-walled capillaries, and in certain places where there were many extravasated red blood corpuscles. Other sections made through the tumor near its axis revealed fairly large bundles of fibrous tissue, infiltrated by the above mentioned spindle cells. A few well preserved cervical glands could be demonstrated. One section was taken from the cut surface, where the tumor was amputated in the region of the internal os. It could be demonstrated that the lining cylindric epithelium was well preserved, the mucosa having normal crypt-like glands and being less lymphoid in character than the uterine mucosa, and quite typical for the cervix. The surrounding layer of smooth muscle fibrils was normal in appearance. No trace of infiltrative invasion of the malignant tumor below could be seen.

Sections, stained by the van Gieson method, presented in some areas single and sometimes small bundles of elongated narrow spindle-shaped cells, staining dark yellow, with a rod-shaped nucleus. Although in some of them a slight longitudinal striation could be seen, it was not possible to find any real cross striation. They were apparently embryonic smooth muscle cells. These could be found anywhere, in the grape-like proliferations directly beneath the epithelium and they had no connection with the musculature of the amputated cervix. They were, however, more numerous near the tumor axis.

The excised lymph node showed slight endothelial hyperplasia, probably in consequence of the moderate infection which the tumor had undergone. No trace of any metastasis could be detected in the lymph node.

The child was seen repeatedly after she had gone home. There has been some irritating discharge at times, but that only lasted for a few days at a time.

On February 15, 1927, the child returned with a recurrence which had been first noticed about one week previously.

Examination showed a mass almost as large as the original growth and similar to it, however the individual grape-like polyps were larger than those of the primary tumor. The point of attachment was sessile in character, and located on the anterior vaginal wall, extending from the vault of the vagina to about two centimeters posterior to the urethral meatus.

No attempt at radical removal was made, but the growth proper was removed and radium seeds were implanted in the anterior vaginal wall and broad ligament regions, radiation amounting to 792 millieurie hours.

Two days following this procedure, the child developed a severe proctitis with numerous watery stools containing gross blood. The temperature varied from 37.5° C. to 41° C. and the diarrhea continued for a period of ten days. One month after the operation, rectal examination showed induration of the posterior vaginal wall. A radium tube was applied to the vagina, radiation amounting to 100 milligram hours. This was followed by no reaction.

Patient was discharged April 17, 1927, having gained from 23 to 30 pounds during the two months' stay in the hospital.

The pathologic picture was very similar to the first sections. Smooth muscle cells were present in slightly greater abundance.

Patient returned to Lakeside Hospital and died April 18, 1928. Only a partial autopsy was permitted. The tumor which filled the pelvis was removed. There was also a large hydronephrosis and hydroneuters due to pressure at the lower end of the ureters. Patient apparently died of uremia.

As previously stated the clinical history of similar cases has proved these tumors to be malignant. However, histologic study does not



always reveal definite evidence of malignancy. That is well brought out in this case.

CASE 2.—M. L., a white woman, twenty-nine years of age, rather short and stout, came to the Lakeside Dispensary on April 24, 1922, complaining of vaginal bleeding. Her last normal menstrual period was January 24, just three months prior to her visit. During the entire three months there had been an occasional show of blood. She had slight lower abdominal pain for one year, nausea for three weeks and for twelve days she had passed small bodies, very similar to small white grapes, and blood-tinged fluid. For twenty-four hours before coming to the dispensary, she had bled freely. There was no severe pain at any time.

Physical examination showed nothing abnormal, except in the lower abdomen and pelvis. Bimanual examination revealed a rather large cervix, especially the anterior lip, with a soft mass protruding through the cervical canal. The fundus was rather irregular and enlarged up to within 4 or 5 cm. of the umbilicus. Speculum examination revealed a mass of grape-like, gelatinous nodules, apparently protruding through the external orifice. A pinkish watery discharge and an occasional streak of bright red blood was escaping through the mass.

A provisional diagnosis of hydatidiform mole was made, but after admission to the hospital more careful examination showed that most of these polypoid growths were derived from the portio and a diagnosis of sarcoma botryoides was made. This was confirmed by microscopic examination of one of these polyps.

The patient had been married thirteen months and this was her first pregnancy. She had had frequency of urination and occasional slight vaginal discharge for about a year.

On May 1, 1922, when the patient was examined under anesthesia, it was found that this polypoid mass arose from the anterior lip of the cervix, extending into the external os and also upon the anterior wall of the vagina. Bimanual examination revealed a uterus about the size of a 2 to 3 months' pregnancy with a mass about the size of a normal uterus, attached to its left side. At operation this mass proved to be the nonpregnant side of a bicornate uterus.

A Wertheim hysterectomy was done. No enlarged lymph nodes were palpated in the pelvis or in the abdomen. Both ureters were dissected down to the base of the bladder and as much of the anterior wall of the vagina as possible was removed.

On pathologic examination the specimen was found to consist of a bicornate uterus, with both tubes and ovaries attached. One cornu was greatly enlarged, measuring 7 by 6 by 2 cm. The other cornu was essentially smaller, measuring 5 by 2 by  $\frac{1}{2}$  by 2 cm. (measurements of preserved specimen). The peritoneal surface of the tubes showed a few fibrous tags and considerable injection of the blood vessels, but both fimbriated ends were patent. The ovaries showed no change. On opening the uterus, the uterine canal was found to be present in both horns. The enlarged one contained a fetus 7 cm. long, showing slight maceration.

The cervix was greatly enlarged and its mucosa roughened and wrinkled. From the anterior lip of the portio a growth extended into the cervical canal for a small distance, measuring about 2 cm. in diameter. It was reddish brown papillomatous tissue consisting of small grape-like berries the size of currents and not showing much solid substance. It extended to the muscular layer of the cervix.

Microscopic sections showed normal squamous epithelium below which there was a loose areolar tissue with round and spindle cells and dark stained round and oval nuclei and a huge number of capillaries, and in certain places collections of extravasated red blood corpuscles. Through a considerable number of fields the tissue was quite cellular, individual cells adjoining one another. There were regions

in which prominent strands of long, rectangular cells under high magnification showed distinct longitudinal striation and also a faint cross striation. With van Gieson stain, these cells were yellow; they were apparently embryonic striped muscle cells.

Slides made from other regions of the tumor showed a loose myxomatous basal substance with large fields of hyaline cartilage, sometimes interlaced by the above mentioned muscle fibrils.



Fig. 2.—Photograph of preserved specimen with fetus in one lobe of the uterus. Case 2.

In places the surface epithelium was absent; in the base there was considerable granulation tissue rich in wandering cells. The whole tumor was very vascular and in a considerable part of it, leucocytes predominated.

The patient made an uneventful recovery, leaving the hospital 18 days after the operation.

On June 1, 1922, radium (1600 mg. hr.) was applied to the upper vagina. On September 9 it was repeated and simultaneously 1200 mg. hr. were applied externally

over the left and 1200 mg. hr. over the right inguinal regions as well as 1400 mg. hr. in the midline above the pubes, making a total of 3800 mg. hr. used on external application. On October 18, 1922, patient came to the dispensary, and stated that she had had no pain or discharge, and had gained 10 pounds since operation. Examination showed the vault to be perfectly healed. There was a small mass in the rectovaginal septum, which felt like indurated tissue.

On November 27, 1922, patient returned complaining of lower abdominal pain of three weeks' duration. The examination was recorded as being negative. She was told to return one month later, but she came back in eleven days, complaining of considerable pain in the lower abdomen and back. There had been frequent and painful micturition and nocturia for about ten days. For one week she had vomited about twice daily and had more or less continuous nausea. Examination showed the vaginal vault smooth; a large tumor, however, on each side of the lower abdomen, could be palpated through the abdominal wall, the larger mass being on the right side. They were very hard, irregular in outline, and tender to palpation. No definite record was made as to the size of these tumors.

This was the last time she was seen at Lakeside Hospital. Later the patient went to a different hospital for examination, and a large mass in the lower abdomen was found. X-ray showed no bony metastases. She left that hospital against advice and died on or about March 12, 1923.

We wish to express our appreciation and gratitude to Dr. Howard T. Karsner, Chief of the Pathological Department of the hospital and Dr. W. H. Weir, Chief of the Gynecological Department, under whose care these patients were treated in the hospital, for their aid and advice in the presentation of this article.

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LOUISVILLE CITY HOSPITAL.

## INTERSTITIAL PREGNANCY

### A REPORT OF AN UNDIAGNOSED CASE WITH FATAL RUPTURE

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**I**NTERSTITIAL pregnancy is by far the rarest of the varieties of ectopic implantation of the ovum with the exception of ovarian pregnancy. A fairly large number of cases have been reported, however, in recent years. Wynne, in 1918, collected eighteen cases and reports the frequency of the lesion as 1.16 per cent of a series of 1547 cases of ectopic pregnancy.

The difficulty of diagnosis before rupture and the danger to life if the diagnosis is not made make the lesion worthy of study. In our own case we were unable to rule out a normal pregnancy and allowed the patient out of our immediate observation, which entailed a fatal delay when rupture occurred.

Mrs. E. V., aged twenty-three years, para i, entered The Lakeside Hospital on March 17, 1925, complaining of morning nausea and vomiting of one month's duration, and of bloody discharge for the past week. That morning she had vomited and fainted and was sent to The Lakeside Hospital from another hospital with a diagnosis of threatened abortion. The anamnesis revealed nothing of importance except an abortion at two months four years before. Physical examination was negative. There was no bleeding. The cervix was practically normal in consistency. There was a slightly softened uterus, symmetric, freely movable, enlarged to the size of a three months' pregnancy. No lateral tenderness or abnormal masses were present. W. B. C. count 9,000. Hg. 80. Blood pressure and urine normal. Temperature range from 37 to 38. Last menstrual period had been December 11, 1924, previous one November 6, 1924.

The patient remained in the hospital four days. There was no recurrence of bleeding. She had no abdominal pain and her slight febrile reaction having subsided she was discharged on the twenty-first of March.

On March twenty-sixth the patient was admitted through the accident ward with a pulse of 140 and of poor volume, and showing all the symptoms of acute occult hemorrhage. She had had a sudden sharp pain at 4:00 A.M. ten hours before admission and had gradually increasing weakness, faintness, and pallor. Her pulse was of very low volume and no donor was available. Her blood pressure continued to fall progressively and an intravenous saline infusion was given immediately.

On pelvic examination there was nothing palpable in the abdomen other than the enlarged uterus. Rupture of the uterus was suspected and although there seemed very little chance of saving the patient it was decided to operate.

A laparotomy was performed and the uterus was found to be enlarged. The musculature of the fundus was torn from a point in the uterine portion of the tube at the left cornu to a point slightly more than half the distance to the opposite cornu. The fetus was in the uterus. Part of the placenta had been extruded into the abdominal cavity. The uterus was bleeding freely from a jagged laceration

which was about three inches long. It was sutured rapidly and the abdomen closed immediately. The blood pressure continued to fall and death occurred about one hour later.

Examination of the uterus which was obtained at necropsy disclosed the left cornu and more than half of its superior surface had been literally shattered as if by an explosion and the remnant of the cornual portion of the tube, which was markedly dilated, had ruptured into the peritoneal cavity as well as into the uterus. (Fig. 1.) The floor of the cavity (*b*) extended medially approximately to the line (*c*) marking the axis of the uterus. The cavity (*b*) showed upon microscopic examination a typical decidual reaction with chorionic villi. Part of the floor or partition between the uterine cavity and fetal sac was composed of muscle showing a decidual reaction both on the side next the fetal sac and the uterine side. Chorionic villi were seen only on the side of the interstitial cavity. There were diffuse adhesions



Fig. 1.—Posterior view of uterus and adnexa. (Autopsy) *a*, Omental adhesions; *b*, interstitial portion, left tube; *c*, axis of uterine canal; *d*, corpus luteum of pregnancy; *e*, adhesions.

on the posterior surface of the uterus involving both ovaries, and the convolutions of the tubes were bound together but the fimbriated ends of both tubes were patent. There was a typical corpus luteum of pregnancy in the left ovary.

It seems quite probable that the implantation in the present case was near the midpoint of the interstitial portion of the tube, inasmuch as rupture occurred both into the uterine cavity and externally. As pregnancy advanced, the muscular sac composing the cornua enlarged sufficiently to accommodate the pregnancy until it was of three months' duration. When the relatively thin musculature was unable to tolerate the strain, rupture occurred as it were centrifugally and centripetally, suggesting that implantation was neither at the tubal nor uterine end of the cornual part of the tube. Nidation at either extremity of the uterine portion of the tube commonly results in rupturing of the tube, tubal abortion or abortion into the uterus. "A shrapnel explosion," as in the present case, occurs usually in implantations of the ovum in the middle of the cornual portion of the tube.

The rupture of a cornual pregnancy may result in a rapidly fatal hemorrhage owing to the extreme vascularity of the pregnant myometrium, and the diagnosis is difficult in the absence of a typical ectopic history. Pain was not present in our case, and this was atypical in that the marked tension which is produced quickly usually causes pain in the expanding cornu as an early and prominent symptom before rupture or fetal death occur.

Uterine asymmetry (Ruge-Simon) in the form of elevation of the cornu on the pregnant side is often very difficult to appreciate at pelvic examination. If development upward takes place the uterus is elongated in the line of least resistance and the adnexa are higher on the affected

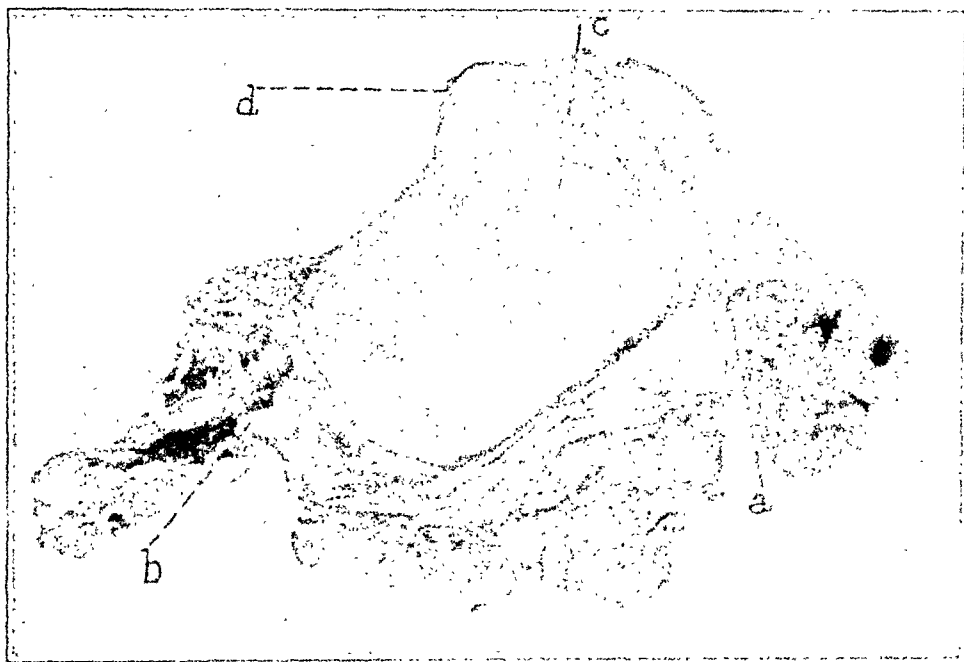


Fig. 2.—Anterior view of uterus and adnexa. (Autopsy) *a*, Insertion left round ligament; *b*, Insertion right round ligament; *c*, axis of cervical and uterine canal; *d*, end of tear in uterine musculature.

side. (Fig. 2, *a*.) This does not follow necessarily if the development of the fetal sac is in a downward direction. The examination of the uterus in this case gave no evidence whatever of asymmetry on careful palpation and in the absence of pain a misdiagnosis seems excusable.

The fact that a patient may come so near the occurrence of a fatal catastrophe without any alarming symptoms whatever emphasizes the necessity for being constantly on the lookout for such a well-concealed disaster. The slightest bloody discharge during pregnancy should be regarded as a danger signal and not dismissed as presumably an innocuous discharge from the lower segment of the uterus not yet obliterated by the placenta and membranes.

# DIFFUSE PELVIC ENDOMETRIOMA CONSTRICTING THE URETERS

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THE case of pelvic endometrioma reported in this communication is of interest because the patient was observed clinically at intervals over a period of five years and a postmortem examination gave us the opportunity of studying the extensive lesions which were present.

The patient, a white married woman of thirty-two years, was referred to the clinic in 1922 with a diagnosis of malignancy of the uterus. The past history relevant to the condition reported begins with the onset of menstruation in the twelfth year. This recurred every twenty-eight days and was of four days' duration. The intermenstrual periods were normal. The amount of blood lost at any time was not unusual, although there was a moderate degree of pain. For three years the pain associated with menstruation had increased, and upon one occasion was associated with difficulty on urination. In addition to the symptoms directly referable to the pelvic organs, the patient had been constipated for two years prior to admission. There had been backache and a dull pain in the left leg for six years and for three years a similar pain in the right leg. These symptoms were more intense during menstruation.

Upon admission to the hospital, the general physical condition was negative. The abdomen upon inspection and palpation presented neither masses nor points of tenderness. Pelvic examination showed induration of the broad ligaments. The cervix was directed upward toward the symphysis, and the body of the uterus retroverted and fixed. Upon the right side of the vagina, beneath apparently normal mucosa, there was a small, indurated mass about 3 cm. in length and 1.5 cm. in width. There were two cystic structures 2 cm. in diameter, one posterior to the cervix, and the other in the posterior vaginal wall nearer the outlet. Upon rectal examination, a firm, irregularly nodular mass projected from the left side into the bowel and partly constricted its lumen. The mucosa covering the mass was not ulcerated. Although these pathologic findings suggested to the patient's physician the presence of a malignant growth of the pelvic organs, the preservation of weight, the general well-being, and the absence of ulceration of the palpable nodules was against this diagnosis. It was believed, rather, that the lesion was a diffuse adenomyoma, or was the result of endometrial implants. An exploratory laparotomy was advised, but the patient refused, and left the hospital without operative treatment.

Subsequently, she was seen at intervals of three to six months up to August, 1926. During this time, no marked changes were noted in the pelvic lesions. The pain during menstruation persisted, being sometimes extremely severe. In June, 1926, a bilateral oophorectomy was urged, but permission for the operation was refused.

In August, 1926, the patient was readmitted to the clinic. At this time, she complained chiefly of intermittent, cramp-like pains extending from the left iliac bone to the knee and occasionally to the foot. This attack came on during menstruation, and was so severe that the patient was hysterical, and morphia was neces-

sary for relief. Attempts to void had been associated with so intense pain there had been retention of urine for twelve hours. When catheterized, 750 c.c. of urine were obtained, and the patient was greatly relieved. The findings on vaginal examination were essentially the same as previously noted. Four days after admission the acute pain had subsided, and she was conscious only of discomfort in the left leg, which showed nothing abnormal beyond a limitation of hyperextension.

During an interval of two months, the patient was relatively comfortable, but in October, 1926, she was seen again at her home because of abdominal pain and difficulty in urination. The last menstrual period had ended three weeks previously, and had been associated with moderate discomfort. The October period had just begun. The day before admission, there was sharp pain involving the left costal margin, the left lumbar and sciatic regions, and the lower abdomen. This pain, in severity and diffuseness, exceeded the previous attacks and differed in that it involved the thigh. The bowels moved without difficulty. Except for pain over the renal region, there were no symptoms referable to the kidney.

Upon admission to the hospital, the blood pressure was 105/70, the temperature 101°, the pulse 100, and the respirations 22. A general physical examination revealed nothing worthy of note except the condition of the abdomen. The latter was symmetrical, but the lower quadrants were distended, and over these portions the note was tympanitic. The right kidney lay in the iliac fossa between the crest of the ilium and the costal margin. The organ was slightly enlarged, movable, and presented a firm, smooth surface. Palpation of the left upper quadrant revealed a soft, cystic tumor extending from the costal margin downward for a distance of about two inches. The tumor, which was slightly movable and tender on palpation, extended laterally to the crest of the ilium and medially to the midline.

*Cystoscopic Examination (Dr. Deming)*—The direction of the urethra was diagonally posterior, as seen in patients with cystocele. The bladder contained 200 c.c. of cloudy urine. Its capacity was 400 c.c. The base of the bladder was elongated, the trigone flat. No tumors, stones, or diverticula were present. The ureteral orifices were large and lay high up on the posterior wall. From the left ureter, thick pus escaped. A number six catheter could be passed for a distance of 12 cm., but it was impossible to pass a number four beyond this point. There was no evidence of function upon the right side, and a number four catheter could be inserted only 1 cm.

*X-ray Examination*.—X-rays and ureterograms were taken of the left kidney and ureter. The first 5 c.c. of sodium iodide solution showed the fluid collected in a dilated ureter. An additional 20 c.c. revealed a stricture near the intramural portion of the bladder, and a dilated, tortuous ureter, which, at the junction of the fourth and fifth lumbar vertebrae, formed an acute angle and followed a course laterally to the crest of the ilium.

Cultures of urine from the bladder and from the ureter were positive for *Staphylococcus aureus*. A diagnosis was made of pyelitis and pyelonephritis on the left side, and a temporary anuria upon the right.

Since the patient showed no improvement, it was decided to drain the left kidney. The operation was performed under local anesthesia. Upon opening the triangle of Petit, the kidney presented, and at the lower border was found a cystic structure which was thought to be the ureter. Upon incising this structure, about 50 c.c. of purulent material flowed out. The lower pole of the kidney was then incised and the finger inserted through the incision into the renal pelvis which contained 500 c.c. of purulent fluid, positive for bacillus coli. A large rubber drainage tube was inserted through the lower pole into the kidney pelvis, and the wound was left open.



The patient stood the operation well, but her condition grew gradually worse, and she died eighteen days later. During this period, the nonprotein nitrogen of the blood increased from 87 mg. to 201 mg. upon the day of death.

*Postmortem Examination.*—The autopsy was limited to an examination through an abdominal incision. Upon opening the abdomen, the peritoneal surfaces were seen to be smooth and glistening, but 150 c.c. of a thin, sanguino-opaque fluid was found in the pelvic culdesac. Innumerable adhesions were present between the coils of intestines, being particularly dense over the large fluctuating mass of the right kidney. The pelvic tissues were densely adherent and formed one solid mass, extending laterally to the innominate bone and coalescing with it through an exostosis.



Fig. 1.—Uterus, bladder, ureters and kidneys removed en masse. Ureters dilated above stricture. Enlarged right kidney with dilated pelvis. Left kidney shrunk following incision and drainage.

Posteriorly, the mass encroached upon and constricted the rectum. The bladder was distended to a point 5 cm. above the symphysis, and the mucosa was congested. The body of the uterus, lying below the bladder, was pulled backward and to the left by adhesions. The cervix was so rigidly fixed in the mass of adhesions that it could not be satisfactorily palpated. The tubes and ovaries presented no gross abnormalities. Scattered over the pelvic peritoneum were tiny brown granular masses. Two small blood clots were attached to the anterior surface of the broad ligament. The kidneys, ureters, and the entire pelvic contents were removed en masse. (Fig. 1.) The right kidney was large, pale, and soft. It measured 14 by 6 by 5 cm. The capsule was thick and densely adherent, except at points where abscesses reached the surface. The cortex and medulla were still distinguishable in

spite of the fact that the kidney was so riddled with abscesses as to scarcely hold together. The left kidney measured 8 by 3 by 1 cm. The lower pole was perforated by the drainage tract. The capsule was thick and very adherent, and throughout the parenchyma were many abscesses. The pelvis was large and baggy, the wall thickened, and the mucosa discolored by petechial hemorrhages. The ureters were tortuous and dilated until they entered the pelvic mass, which definitely constricted them.

The uterus measured 8 cm. in length and 4.5 cm. across the fundus. The myometrium averaged 2 cm. in thickness. The cervix was small and symmetrical. In the right side of the vesicovaginal septum were two purple elevations 1 to 1.5 cm. in length. On section, these were filled with a dark brown fluid. The mass constricting the ureters was composed of interlacing fibers, among which were small brown masses and minute open spaces. The portion of the mass encroaching upon the rectum was gray and dense.



Fig. 2.—Glands surrounded by stroma present in pelvic mass.

*Microscopic Examination.*—The glomeruli of the right kidney varied greatly in size, but were the least involved of the renal structures. The epithelium of the tubules was flattened and the lumina were distended with white blood cells. The connective tissue was increased. The organ was massively infiltrated with polymorphonuclear leucocytes. The increase of connective tissue in the left kidney was greater than in the right. The cellular infiltration was dominantly lymphocytic. The tubules, lined by a low, much vacuolated epithelium, were dilated, and for the most part empty.

Each ureter, with the mass surrounding it, was sectioned in one piece. The muscular coats of both ureters were hypertrophied. Sections of the ureters taken above the pelvic mass showed an intense infiltration of the submucosa, and to a lesser degree of the muscular layers, with lymphocytes and plasma cells. The lumen of the left ureter, when it passed through the pelvic mass, was almost obliterated, and was devoid of epithelium.

Sections taken through the dilated ureters, which practically obliterated the lumen and glanded and constricted the ureters, showed some tubular and some

nective tissue traversed by small capillaries. Scattered throughout the muscular and connective tissue structures were irregularly dilated glands lined by low columnar cells, whose large, dark oval nuclei almost filled the cytoplasm. No mitosis was observed. (Fig. 2.) The basement membrane was intact. In certain of the glandular cavities irregular granular particles of brown pigment and shadows of red blood cells were seen. Free and phagocytized pigment was also found in the stroma. In some sections the glandular structures lay free in a bed of dense fibrous tissue; in others, they were surrounded by a varying quantity of loose stroma, the cells of which contained oval nuclei, with regularly distributed chromatin. (Fig. 3.) The loose stroma definitely resembled that of the uterine mucosa. A few disintegrating columnar epithelial cells were found in the clot attached to the broad ligament.

Sections through the uterus showed the endometrium and myometrium clearly demarcated. The glands of the former were small and characteristic of the resting stage. The myometrium showed the usual tortuous pattern of smooth muscle and a slightly increased quantity of connective tissue. The cyst found in the vault of the vagina was lined by cuboidal epithelium, which at certain places was three

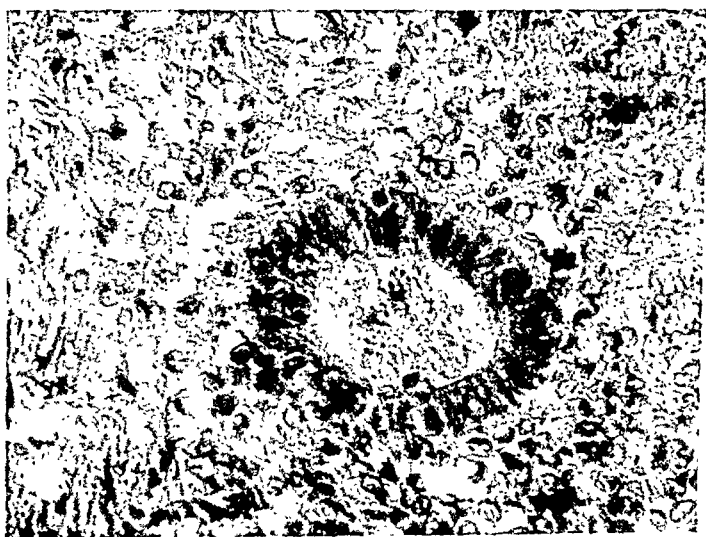


Fig. 3.—High power microphotograph of gland and stroma present in pelvic mass.

to four cells deep. The cervical epithelium was hyperplastic and in the wall of the cervix were two small cysts lined by flattened epithelium. One of these cysts contained old blood.

Sections of the ovaries showed a corpus hemorrhagicum and several corpora albicantia. No endometrial tissue could be demonstrated. Sections of the tubes showed nothing worthy of note.

*Anatomic Diagnosis.*—Pelvic endometrioma involving the parametrial tissues and constricting the ureters; chronic cystitis; ureteritis, pyelonephritis, bilateral, recent operation (pyelotomy, left); metastatic abscesses of lung and spleen; emaciation.

#### SUMMARY

The clinical history and the postmortem findings are given in the case of a patient who was under observation over a period of five years for a diffuse pelvic lesion. This was complicated later by a bilateral renal involvement which led to death. There were no changes within the uterus itself. It was distorted by the mass of dense tissue which

fixed all the pelvic structures and encroached upon and constricted the lumina of the rectum and ureters. A histologic study of this indurated mass showed it to be made up for the most part of connective tissue, throughout which were scattered irregularly dilated glands lined by low columnar epithelium. Some of these glandular structures lay free in a bed of fibrous tissue, while others were surrounded by a varying quantity of loose stroma. In some of the gland lumina irregular granular particles of brown pigment and shadows of red blood cells were seen.

From the histologic study of the specimens, we believe that we are dealing with an unusually diffuse type of endometrioma. The structure of the glands is quite like that found in the uterus, while the epithelium lining the glands and the stroma surrounding them is similar to that found in the endometrium. Moreover, the presence of pigment and of shadows of red blood cells in the gland cavities indicates that these ectopic structures underwent the physiologic changes which characterize the menstrual cycle. Further evidence that this activity took place is found in the fact that the acute attacks of pain were associated with the onset of the menstrual period. Similarly, the recurring pain in the legs doubtless resulted from pressure by the swollen tissues upon the pelvic nerve trunks. That the cells were deposited from a secondary endometrial cyst of the ovaries is ruled out by the relatively normal structure of these organs. It seems, therefore, that the original epithelial structures may have come, as Sampson has suggested, either from the mucosa of the tubes or by transportation from the cavity of the uterus. Finally, it is clear that the bilateral renal lesions depended primarily upon the presence of the pelvic endometrioma, which had gradually encroached upon and constricted both ureters.

# THE ANATOMY, GENESIS, AND CLINICAL CONSIDERATIONS OF PLACENTA ACCRETA\*

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AN ORGAN whose structure is so complex, and which is so highly endowed with many varied and important functions as is the placenta, would appear to be subject to the frequent occurrence of pathologic variations. This in turn seems to be favored by the remarkable rapidity of its growth to maturity, and in fact senility, in such a short time as ten lunar months.

This communication deals with that rare placental anomaly designated as placenta accreta and the extremely disastrous results which may accrue from failure to recognize the lesion, and the consequent institution of incorrect measures to counteract the complication. There are also many clinical and anatomic considerations connected with placenta accreta, some of which are still mooted, so that a discussion of these in the light of recent studies together with those involved in the case to be presented, should, it is hoped, prove of some interest.

I desire to preface the case report by expressing my gratitude to Dr. Nathan Ratnoff, for the rare privilege of allowing me to study this case which occurred on his service.

## CASE REPORT

Mrs. L. F., Hebrew, para ii, aged thirty-seven, admitted to the Jewish Maternity Hospital, June 7, 1925, in active labor. Her previous medical and surgical histories were essentially negative. Her first pregnancy terminated in a stillbirth at term in July, 1924, of undetermined cause. No difficulty was encountered in the delivery of the placenta, and no complications occurred in the puerperium. The patient was a short, rather stout woman at term, whose general condition was excellent. Pelvic measurements were ample. The head was engaged in the L. O. A. position, but the fetal heart was not heard at the time of the patient's admission to the hospital, nor at any time throughout her labor. She was delivered of a still-born female child five hours after admission. Following the delivery of the child, the placenta did not come away. It is important to note that no bleeding was present at this time. In view of the fact that at the end of three hours, the placenta was still within the uterine cavity, and no bleeding had occurred, the possibility of an adherent placenta was suspected. Four hours after the birth of the child, the uterine cavity was explored under anesthesia, under the strictest aseptic precautions, and while small parts of the placenta came away on the examining hand, no line of cleavage could be detected. No further intrauterine manipulations were attempted, and a diagnosis of placenta accreta was made. The uterine cavity was tightly packed with iodoform gauze. Hysterectomy, which was advised, was agreed to by the patient, and the operation was performed eight hours after the delivery of the child. The operation was easily carried out, only the uterus being removed. The patient reacted in a satisfactory manner, and after an uneventful convalescence, was discharged in excellent condition, fifteen days postpartum.

\*Read, by invitation, before the Section on Obstetrics and Gynecology, New York Academy of Medicine, April 26, 1927.

Pathologic report by Dr. Alfred Plant, Pathologist of the Woman's Hospital, New York City.

*Gross.*—The specimen which had been in some fixing fluid for about two years has the following gross aspects. Open uterus with a large mass of placental tissue protruding from the opening. The longest diameter of the specimen is 17 cm., the two others are 12 cm. and approximately 7 cm. The specimen is quite distorted and does not show the landmarks for easily establishing the site of the fundus and cervix. Probably the shorter diameter corresponds to the axis of the body of the uterus. The placenta is chiefly attached to the upper part of the corpus. The average thickness of the uterine wall is 5 cm. Spongy placental tissue and firm myometrium can be seen on the cut surface in direct continuity with each other and without any demarcation line between them. Additional cut surfaces



Fig. 1.—Section from a case of placenta accreta, showing the attachment of the placenta in direct continuity with the myometrium, without the interposition of a spongy layer of the decidua basalis, and the invasion of the myometrium by the chorionic villi.

give essentially the same picture. At other points, however, the fixed tissue, when it is bent breaks at the junction of the placenta and myometrium. The cut surfaces of the placental tissue itself show nothing particular, neither do the cut surfaces of the myometrium. At the attachment of the placenta, the average thickness of the myometrium is only about 2 cm.

*Microscopic.*—In several sections, the chorionic villi and the masses of the trophoblast are seen to be directly situated upon the myometrium, without a spongy layer intervening. The invasion of the chorionic elements does not go deeper into the muscle than it frequently does even in normal placentation. At several points necrosis and hyalinization of placental tissue are seen. There are also small areas of calcification. Sections far away from the placental site show the usual white Opitz glands and partly calcareous decidua between them.

*Diagnosis.*—Placenta accreta.

*Incidence.*—From a study of the literature, the frequency of placenta accreta can be said to be controversial. Statistics vary from one in six thousand cases as reported by Polak, to one in forty thousand cases, as stated by B. C. Hirst. In a personal communication, Dr. Harold Bailey informed me that in over twenty years' experience on two active teaching services, he has seen three cases of placenta accreta. While no doubt many obstetricians may lay claim to having seen cases of placenta accreta, they fail to give the essential details of the gross, and particularly the minute, anatomy by which alone the diagnosis can be determined, and the claim to placenta accreta be substantiated. Such frankly missed or unconfirmed examples may well amount to a considerable number of cases, while the true nature may be suspected, but they are not sufficiently definite to warrant publication.

The failure of practitioners to report cases, and the variations in their correct interpretation of the condition seemed to warrant an attempt to determine if possible, the approximately correct incidence of the lesion. To that end, therefore, a study was made of its occurrence in the obstetric services of the Jewish Maternity Hospital, the Woman's Hospital, and the Berwind Maternity Clinic, all of New York City. In a collective series of about seventy-five thousand consecutive cases, four cases of true placenta accreta have been encountered. Thus it would seem that a fairly correct estimation of the incidence of the condition would place it at about one in twenty thousand cases. A study of the literature by the writer has shown nine authentic cases to have occurred since 1924, giving a total of thirty-six cases reported to date.

#### ANATOMY

Placenta accreta is represented by a definite anatomic-histologic picture. Macroscopically, the placental base is thinned out in practically its entire course. Hence the predisposition to rupture of the uterus even on the slightest manipulation is readily explained on this anatomic defect. While in Dietrich's case the uterine wall is nearly completely absent, such is not the finding in our specimen and in the majority of cases reported to date.

Microscopically, the factor which is essential in order to designate the lesion as a placenta accreta, is the insufficient development or entire absence of the decidua basalis, which defect must be demonstrable beyond a doubt, so that the placenta is found to be inserted directly on the muscularis, *without* the interposition of a mucous membrane, with or without a direct invasion of the myometrium by the chorionic villi. Hence, on etymologic grounds, I would suggest that the term *accreta* be applied to the lesion when the former condition is present, and *incrcta*, when in addition to the defective or absent basalis, the villi are found to invade the muscularis of the uterus. It will thus be seen that the anatomic aspects of the problem explain very adequately that the diffi-

culty in the separation of the placenta is due to a faulty fragility of the placental base, in turn due to the penetrative attachment of the organ.

#### GENESIS

In order to appreciate the processes which are operative in placenta accreta, it would perhaps be in order to briefly recall the mechanism of the normal separation of the placenta. In 1875, Langhans demonstrated that the placenta does not loosen in the compact layer, but at the junction of the compacta and spongiosa. Hence, it follows that any alterations from the normal in the embedding of the placenta will be productive of difficulty in its separation.

Since it is recognized that the change in the structure of the decidua basalis or the lack of the mucosa of the basalis is the reason for the difficult separation, it is necessary to understand why the placental site shows these changes. Hinselmann, who has made an exhaustive study of the subject under discussion, feels that the first step in this direction is the examination of the decidua vera. But unfortunately, as he points out, the decidua vera is only rarely examined. In the case reported by Dietrich in 1922, it was found to be completely lacking. It is also pointed out that Robert Meyer emphatically does not speak of a parietalis (decidua vera). Similarly, Newmann has examined a deep-seated placenta and is not very certain that he had examined portions outside of the placental base. While in our case, sections far away from the placental site showed partly edematous decidua, we are not inclined to draw any conclusions on the basis of one case.

Hinselmann, however, offers the following statement. In the cases of a normally situated placenta accreta in which the parietalis is examined, it is either not demonstrable or it is extremely rudimentary. In the cases of deeply situated placenta accreta the parietalis of the higher sections of the uterus has been found to be normal in several cases. He is, therefore, led to distinguish the following two categories:

1. The normally situated placenta accreta. In this connection he raises the question that after the absence of a basalis has found its analogue in a lack of or excessive reduction in the parietalis, did this reduction of the parietalis exist at the beginning of pregnancy or did it occur in its course? A logical answer to this can only be derived from clinical observations. The fact that many of the women have a history of repeated manual separation would make it appear that there must be some persistent underlying cause. He, therefore, feels that a mucosal change was already present prior to the onset of pregnancy. On the other hand, the condition of the mucosa in the interval of pregnancy cannot be satisfactorily answered by clinical experience, since other factors, especially ovular ones play a rôle. The question as to whether it is not a congenitally unsuitable mucosa cannot as yet be answered, but from the information at hand it seems unlikely.

The majority of writers feel that while the first manual separation was performed for other reasons than placenta accreta, nevertheless the manual separation so reduced the uterine mucosa, that it did not regenerate to its normal thickness.



Similarly, frequently repeated curettages, deep-seated infectious processes which follow manual separation, as well as instrumental curettage of the uterine cavity in the gravid state, and particularly in early puerperal cases are especially to be feared. Hence, it is fair to state that all of these causes unite themselves to produce deleterious results as manifested by an unfit placental base with the consequent penetrative attachment of the placenta.

2. In reference to the deeply situated placenta accreta, the principles just described hold true, since here also the mucosa is found to be thin, thus predisposing to the development of placenta accreta.

It is also claimed by some writers that the tubal angles and the lower uterine segment show a predisposition to placenta accreta on account of the thinness of the mucosa in these regions. In like manner, submucous myomas are referred to as favoring the development of placenta accreta. In this connection, Hinselmann quotes Frankl's investigations on the reaction of the mucosa in centripetally growing interstitial and submucous myomas, which lead to a reduction of the mucosa, and as pointed out by these writers, in the cases of the submucous type of growth, one can speak at times only of a covering epithelium. Hence, there also exist in the lesions just mentioned, conditions suitable for the formation of placenta accreta. Similarly, it is claimed that the septum of a uterus bicornis unicollis and the rudimentary accessory horns of the uterus possess the adaptability to the development of accreta.

Before leaving this part of the subject, one must call attention to the fact that a study of the literature shows that theoretically, at least, placenta accreta is possible at any period of gestation after the third month, since Tennant's case occurred in the fifth month of pregnancy. In the case reported by this writer and his collaborators, it was demonstrated that the placental attachment may not alone invade the peritoneal coat of the uterus, but actually invades the visceral cavity. In this case, from the appearance of the crater where the placenta extruded through the uterine wall, one can readily see the possibility of the growth extending over and into the bladder, bowel, and mesentery.

Tennant's case concerned a para v, with a history of four previous manual separations of the placenta. In her fifth pregnancy she was treated for a threatened miscarriage in the fourth month, and one month later miscarried. As the placenta would not come away spontaneously, manual removal was attempted but without success. There was no bleeding for thirty-six hours, at the end of which time exploration of the uterine cavity showed that no line of cleavage could be found. Hysterectomy was advised but was refused by the patient, and she died of acute sepsis at the end of eight days. At autopsy, the placenta was found adherent to the vault of the uterus, and had grown through its wall which was found to be exceedingly thinned out at the point of attachment of the placenta, only the peritoneal coat being left.

## CLINICAL CONSIDERATIONS

Polak has pointed out the characteristic clinical findings in placenta accreta. Separation of the normal placenta does not occur without bleeding. He, therefore, emphasizes this in giving the differential diagnosis between the simple retention of a separated placenta and placenta accreta. In the former, three clinical signs are always evident: (1) uterine bleeding, (2) descent of the umbilical cord, (3) the characteristic ball-like condition of the fundus. Conversely, provided there has been no manipulation to cause partial detachment of a placenta accreta, there is neither hemorrhage, descent of the umbilical cord, nor changes in the position of the fundus, the latter assuming a characteristic shape, which as pointed out by Polak causes it to be broader from side to side, intermittently relaxed, and *not* assuming the ball-like shape characteristic of the normal placenta which has separated.

In this connection one would call attention to the differentiation of accreta from the so-called adherent placenta, which is due to a disturbance in the mechanism of separation, and not to an anatomic defect. Here the line of cleavage is always found, and manual removal is not usually attended with great difficulty.

Hence, in the presence of a delayed delivery of the placenta, particularly in the absence of hemorrhage, the attending obstetrician should be on the *qui vive* for the possible existence of placenta accreta. If after a reasonable length of time the clinical signs of separation enumerated above are not present, no attempt at Credé delivery should be made. Immediate steps should be taken to explore the uterine cavity under the strictest aseptic precautions under anesthesia, to determine what subsequent measures should be instituted. If upon entering the uterine cavity no line of cleavage is found to exist between the placenta and the uterus, hysterectomy is the only rational procedure, for by this alone can rupture of the uterus be avoided and the patient saved from death which usually follows this catastrophe, as a result of hemorrhage or sepsis.

To substantiate this assertion, one need only assemble the cases reported within the past few years. In practically every one in which attempts to separate the placenta in the presence of an accreta were made, the patient succumbed either to hemorrhage, shock, or sepsis. Of the three cases seen by Polak the only recovery occurred when supra-vaginal hysterectomy was performed. We attribute the satisfactory outcome in the case here reported to the prompt recognition of the accreta, and the performance of hysterectomy without the previous institution of meddlesome maneuvers.

In the discussion of Polak's paper, Frankl unqualifiedly subscribed to the tenet that in a case of anatomic placenta accreta, the indication is definite for extirpation of the uterus. As a proof against the futility of attempting to separate the placenta, and resorting to less radical

treatment than hysterectomy, as advocated by B. C. Hirst and others, Frankl cites two cases in which he had performed postmortem examinations. It was found absolutely impossible to separate the placenta from the uterine wall. It is, therefore, justifiable to assume that the high mortality hitherto reported has been due, it would seem, to the expectant or supportive treatment, since twenty-four of the twenty-six cases reported up to 1924, resulted in the death of the patient.

#### SUMMARY AND CONCLUSIONS

As a result of this study, the opinion may be confirmed that although placenta accreta is a rare obstetric anomaly, it possesses definite anatomic-histologic properties as reflected by a defective or absent spongy layer of the decidua basalis. The incidence of the lesion is about one in twenty thousand cases. The frequency in the history of abnormal detachment of the placenta would suggest that any condition which leads to an atrophy of the endometrium is a predisposing factor to the development of placenta accreta. At the same time, the possibility must be entertained that the fault may lie in an improper development of the corpus luteum, since it is known that this is the factor which controls the normal development of the decidua.

Unless previous manipulations have been made to cause partial detachment of the placenta, the condition is recognized by a failure at separation of the placenta, and by an absence of bleeding. This is corroborated on exploration of the uterine cavity by a failure to find a line of cleavage between the placenta and the uterus whenever placenta accreta is present. As soon as the diagnosis has been made, hysterectomy is the only rational procedure, for this offers the best hopes for the patient's life, and is the most favorable in reducing the mortality of this very serious obstetric complication.

I desire to express my sincere appreciation to Dr. Alfred Plaut and Dr. Morris Dreyfuss of the pathologic department of the Womans Hospital, New York City, for their kindness in examining the microscopic sections, and for much valuable aid in this study.

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# A REVIEW OF ONE THOUSAND AND ONE OBSTETRIC CASES\*

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FROM October 1, 1925, to December 31, 1926, there were admitted to the Jewish Maternity Hospital 1001 pregnant women who were delivered of 1014 infants. Of these patients 460 were private cases and 541 were ward cases.

The private cases were attended by the members of the staff and by other physicians to whom the courtesy of the hospital had been granted.

The work in the wards, with the exception of the complicated cases, was conducted by the chief resident physician, and the interns under his supervision.

The ward patients, with the exception of an occasional emergency case, registered previous to their admission to the hospital and received careful prenatal care.

Of these patients who attended regularly the prenatal clinic, none developed eclampsia. There were, however, 18 patients admitted with preeclamptic symptoms, such as a rising blood pressure, albumin and casts in the urine, headache, dimness of vision and edema. Of these patients 12 were ward and 6 were private. Of these 18 patients, 5 were delivered of twins.

A list of presentations and positions are shown in Table I.

TABLE I. PRESENTATIONS

Vertex	974	
Anterior position	812	or 80.1%
Posterior position	156	or 15.1%
Face	6	or .6%
Breech	31	or 3.1%
Transverse	4	or .4%
Unrecorded	5	or .5%

Of the 1001 patients 738, or 73.8 per cent, had normal deliveries. The number of patients delivered with forceps was 221, or 22.1 per cent.

TABLE II. METHOD OF DELIVERY

Normal delivery	738	73.8%
Cesarean section	5	.5%
Version	21	2.1%
Forceps	221	22.1%
Total	1001	

\*Read at a meeting of the Philadelphia Academy of Obstetrics and Gynecology, December 15, 1927.

TABLE III. FORCEPS DELIVERIES.

Private patients	460	Ward patients	541
High forceps	4	1	
Mid forceps	53	30	
Low forceps	77	59	
After-coming head	10	0	
	144, or 31%	90, or 16%	

*Forceps.*—From Table III it is evident that the total percentage of forceps deliveries is rather high. However, the 16 per cent of forceps deliveries in the ward patients contrasted with 31 per cent in private patients demonstrates emphatically what may be accomplished by watchful waiting and allowing nature its full opportunity.

Watchful expectancy, however, must be tempered with good judgment and in the presence of distinct indications, nature should be assisted promptly.

The indications for the so-called prophylactic forceps seem to be more numerous and more urgent in private patients.

*Version.*—Twenty-four patients, or 2.4 per cent, were delivered by podalic version, as shown in Table IV.

TABLE IV. VERSION—INDICATIONS

Premature separation of placenta	1
Occiput posterior	5
Prolapsed cord	5
Placenta previa	5
Twins	4
Heart disease	1
Time	3
	24

Infant mortality 5, or 20.8 per cent. In these cases of version there were 5 infant deaths, a mortality of 20.8 per cent. One infant death occurred five days after delivery in a seven and a half months' gestation in a mother who had a mitral stenosis and a lobar pneumonia. The second death was in a case of central placenta previa and the third in a case of marginal placenta previa. The fourth fatality was in a case of prolapsed cord. The fifth death was in a case of premature separation of the placenta. The mother was moribund when admitted and a version was done with the remote possibility that the child might be saved.

*Cesarean Section* was performed on only five patients, or one in 200 cases, without a maternal or fetal death. The indication in all cases was a contracted pelvis and the classical operation was performed.

The complications encountered in these 1001 cases were as follows:

TABLE V. COMPLICATIONS

	NO. CASES	STILLBORN	INFANT DEATH
Placenta previa	8	2	0
Premature separation of placenta	6	2	1
Prolapsed cord	10	2	1
Contracted pelvis marked	10	1	0
Preeclampsia	18	8	0
Cardiac disease of mother	47	0	1
	<u>99</u>	<u>15</u>	<u>3</u>

In these 99 complicated cases there were 18 infant deaths, a mortality of 18 per cent.

*Placenta Previa.*—The 8 cases of placenta previa consisted of 1 central and 7 marginal previas. All occurred in multipara. Of these, 5 were delivered by podalic version with 2 fetal deaths, and three were delivered with forceps. The case of placenta previa centralis had been packed and the fetus was dead when the patient was admitted. Of the 7 cases of previa marginalis, 2 were treated by Voorhees bags and forceps; 4 had vaginal packing and version with one infant fatality; one had vaginal packing and forceps.

*Premature Separation of Placenta.*—There were 6 cases of premature separation of the placenta. Of these cases, 4 were delivered with forceps; one by podalic version and one with a breech presentation had a spontaneous delivery.

In these cases there were 3 fetal deaths; two were in cases delivered by forceps and the third fatality was in the version delivery; the mother being moribund when admitted.

*Prolapsed Cord.*—There were 10 cases of prolapsed cord. Of these, 2 were forelying cords, palpable through the os, but in the intact bag of waters. In the other 8, the cord was prolapsed into the vagina. Of these 10 cases, 5 were delivered by version, with one fetal death; 2 were delivered with forceps, with 2 deaths. In the remaining 3 cases the cord was replaced and the delivery was spontaneous.

*Contracted pelvis (marked).*—There were 10 cases of marked contraction of the pelvis. Nine of these patients were given a test of labor. The tenth patient had an elective cesarean section. Of these 10 cases 5 were delivered by cesarean section, the other 5 were delivered with forceps, with one fetal death.

Among these 1001 cases there were 10 patients who had had cesarean sections in other institutions for pelvic contraction. They were advised to go into labor and all were successfully delivered by forceps of normal babies.

*Preeclampsia.*—There were 18 patients admitted with preeclamptic symptoms. The treatment consisted of rest in bed, strict diet, free purgation, 20 c.c. of a 10 per cent solution of magnesium sulphate intravenously repeated as often as was necessary. Patients with a blood pressure of 200 or above, had a venesection.

The patients in whom the toxemia was progressive had labor induced by the Voorhees bags. The remaining 16 patients had a spontaneous labor. In these preeclamptic patients there were 8 infant deaths which were classified as follows:

Premature spontaneous	2
Macerated spontaneous	3
Full-term spontaneous	1
Induction—Voorhees bags	2
	<hr/> 8

*Cardiac Disease in Mother.*—In these 1001 mothers there were 47 who had pronounced cardiac lesions. The treatment consisted of absolute rest in bed for several weeks before the delivery and such medication as was necessary; each case being individualized. These patients were allowed to go into natural labor. Morphine and scopolamine or morphine and magnesium sulphate were given during the period of dilatation. At the end of the first stage of labor under light anesthesia the deliveries wherever possible were completed. The methods were as follows:

Normal	12
Forceps	34
Version	1
	<hr/> 47

After delivery these patients were kept in bed for at least four weeks or longer if necessary.

In these 47 cases there was one fetal death in a patient who had pneumonia and a mitral stenosis. The baby lived five days.

*Morbidity.*—In computing the morbidity we have considered that every patient who had a temperature of 100.4° F., twice in one day excluding the first twenty-four hours, to be morbid. Among the 1001 patients there were 40, or 4 per cent who had abnormal temperatures. In this connection it is interesting to note that the morbidity in the private patients was 5 per cent while in the ward patients it was only 2.9 per cent.

The higher morbidity among the private patients may be explained by three factors. First, the private patients were usually examined more frequently *per vaginam*. A ward patient seldom had a vaginal examination, the progress of labor being followed by rectal examinations. Second, the private patients were not only delivered by members of the staff, but by many nonstaff doctors to whom the courtesy of the hospital had been granted and whose technic was varied. The ward patients were delivered by members of the staff only and the technic was uniform. Third, there was decidedly more interference with labor among the private cases than among the ward cases. This traumatism from interference was probably the largest factor in the higher morbidity among the private patients.

*Infant Mortality.*—The infant mortality has been classified as follows:

	STILLBORN	INFANT DEATHS
Macerated	16	0
Premature operative	0	1
Premature spontaneous	4	5
Full-term operative	9	7
Full-term spontaneous	3	4
	<hr/> 32	<hr/> 17

Of the 1014 infants delivered there were 49 deaths, a mortality of 4.8 per cent. The fetal mortality would be reduced to 3.2 per cent if the 16 macerated infants were eliminated.

*Maternal Mortality.*—The maternal mortality in these 1001 cases was 2, or 0.2 per cent. The first fatality was in an elderly multipara who was told at another hospital that she had a premature separation of the placenta and should have a cesarean section. She left the hospital against advice. She continued to bleed for forty-eight hours more and was then rushed to the hospital, was moribund when admitted and died twenty minutes later.

The second was in a multipara, with advanced mitral stenosis and decompensation. She had disregarded the prenatal advice of her physician and he refused to continue with the case. When admitted she had a right lobar pneumonia. She was delivered by podalic version and died forty hours later of cardiac failure. The baby lived five days.

The first fatality should be excluded as the patient was moribund when admitted. With this patient eliminated the actual mortality was 0.1 per cent.

It might be interesting to note that during the time these 1001 patients were being treated there occurred at one time in the nursery many cases of what appeared to be clinically an abortive form of simple impetigo (pemphigus neonatorum). Cultures of these cases were either sterile or showed a staphylococcus of low virulency. The first few cases were mild in character, but later cases seemed to be more virulent and less amenable to treatment. The attending dermatologist, Doctor S. Greenbaum, who investigated the condition suggested that liquor cresolis comp., which was being used freely around the hospital might be the cause of the irritation. Following his recommendations, the use of that antiseptic was discontinued and the cases gradually disappeared. From then on there has been no recurrence of this condition.

*Postpuerperal.*—The patients before being discharged were invited to return to the postpuerperal clinic in from four to six weeks for examination and any necessary treatment. Many of the patients returned voluntarily and others were sent in by the Social Service Department. By these means it has been possible to keep a follow-up on 80 per cent of the clinical cases. Of the 432 patients who returned to the post-



puerperal clinic, lacerations of the perineum were found in 272, or 63 per cent. Lacerations of the cervix were found in 391, or 90 per cent.

In the first 100 patients who returned to the postpuerperal clinic, 39, or 39 per cent, had retrodisplacements of the uterus. It was then decided to eliminate the abdominal binder at the end of twelve hours and to have the patient lie on the abdomen a considerable time each day. After the tenth day the patients, with empty bladders, were placed in the genupectoral position for ten minutes morning and night and were instructed to continue with the treatments until they returned to the clinic.

After these changes had been made, retrodisplacements were found in 73 of 332 patients, or 22 per cent, a reduction of 44 per cent. Of the 112 cases of retrodisplacements, 65 were cured by restoring the organ to its normal position and by the continuation of the genupectoral position morning and night. The remaining 47 patients had pessaries inserted, 9 of these under gas anesthesia. Of the 47 pessary cases 21, or 45 per cent, were cured. In the remaining 26 cases when the pessaries were removed several months later, the uterus returned to the posterior position. Of this group in 12 cases the displacements caused no symptoms, while 14 had well marked symptoms.

Of the 112 cases of retrodisplacements of the uterus, 86, or 77 per cent, were cured.

#### CONCLUSIONS

Careful prenatal care as carried out in all well-regulated clinics, saves many patients later complications and reduces maternal and fetal mortality.

Watchful waiting and allowing nature its full opportunity will diminish the incidence of forceps deliveries and extensive lacerations.

The majority of cases of placenta previa can be successfully treated conservatively. Only a very small percentage of cases require cesarean sections.

Contracted pelves are only relative and much depends on the size and position of the child. Unless there is a decided disproportion, the patient should be given a real test of labor before a cesarean section is elected.

Pregnant women with cardiac diseases should be treated by prolonged rest in bed, proper medication and analgesic remedies during the first stage of labor and then delivered with forceps under light anesthesia.

Elimination of the abdominal binder after twelve hours, position and exercises will materially reduce the number of retrodisplacements of the uterus.

The postpuerperal supervision and care of the patient is most beneficial and should receive more earnest and efficient attention.

# TEN YEARS' EXPERIENCE WITH GYNOPLASTIC REPAIRS OF OLD LACERATIONS FOLLOWING CHILDBIRTH, WITH REPORT OF 1019 CASES\*

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ANY new or radical procedure from the orthodox methods is always viewed with scepticism and distrust. It takes time, experience, and the evidence of final results to prove whether the change advised is safe and justifiable. What was radical and dangerous a generation ago, can now be done in safety and with satisfactory end-results, due to the remarkable progress that medicine has made since the discovery of asepsis, antisepsis, and anesthetics.

Has obstetrics kept pace with and made use of this progress and advancement? The laity, general practitioners, and even many obstetricians do not realize that childbirth should be given the same consideration as major surgery and that the obstetric case is entitled to and should demand the benefits resulting from surgical progress. We hope that the day will come when every woman can be delivered under anesthesia in a well-regulated hospital, so that the results that we have obtained can become universal.

It has been our routine for many years to examine the cervix, vaginal walls and perineum after the expulsion of the placenta for old as well as new lacerations and to repair them as soon as possible. The present review deals with a report of 1019 cases which were operated during the past ten years by the obstetric staff at Mount Sinai Hospital of Cleveland. Our observations have proved that about 50 per cent of the multiparas delivered were in need of gynoplastic repair for old lacerations. (Table I.) During the last five years, the ages of patients operated varied from 18 to 47 years (Table II), and the parity varied from ii to xiv (Table III).

TABLE I. OBSTETRIC ACTIVITY AT MOUNT SINAI HOSPITAL IN 1926

Total admissions		886
Primiparas	373	
Cesarean sections; obstetric complications, as eclampsia, heart or kidney disease; multiparas that did not need repairs or refused to have them done, etc.	340	
Total	713	713
Multiparas repaired		173
i.e. 19.5% of total admissions in 1926 were repaired, or 33.% exclusive of the primiparas		

\*Read before the Chicago Gynecological Society, Meeting of November 18, 1927.

TABLE II. AGE

Para ii

	18	19 to 24	25 to 28	29 to 32	33 to 37	38 to 47
1922		19	35	51	49	16
1923		14	36	63	28	20
1924	1	22	45	59	60	20
1925		23	36	46	39	18
1926		18	46	51	42	16

TABLE III. PARITY

YEAR	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIV
1922	68	51	22	16	4	4	2	1	1			
1923	60	50	23	9	11	4	3					
1924	82	51	28	16	15	3	4	4	2	1		1
1925	61	35	28	13	8	4	4	5	1	1	2	
1926	52	51	30	16	14	5	1	2	2			
Total	323	238	131	70	52	20	14	12	6	2	2	1

TABLE V. TYPES OF DELIVERIES FOLLOWED BY GYNOPLASTIC REPAIRS FOR OLD LACERATIONS

	PR.	SP.	L. F.	M. F.	V. E.	BR.	DIL. C. L. F.	MAC. F. L. F.	SC. M. F.	DIL. C. M. F.	BAG BR.	DIL. C. V. E.
1922		99	54	5	8	3						
1923		100	34	2	11	3	2	1	4		1	1
1924		106	48	10	14	3			4	3		3
1925	5	88	42	9	12	2			2	1		1
1926	1	108	32	7	12	4			5	1		3

Pr., Precipitate. Sp., Spontaneous. L. F., Low forceps. M. F., Mid forceps. V. E., Version and Extraction. Br., Breech. Dil. C., Manual dilatation of cervix. Mac. F., Macerate fetus (afebrile). Sc., Scanzonian maneuver.

TABLE VI. DAYS IN HOSPITAL FOR DELIVERY AND REPAIR

	4 TO 10 DAYS	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25 TO 43 DAYS
1922					32	39	36	18	27	9		4	2	2		
1923	5	6	11	14	20	31	26	14	7	6	7	5	3		1	2
1924		2	1	11	25	33	49	31	20	8	6	3	3	2		6
1925	3	6	3	10	38	11	22	25	14	7	5	2	6	2	1	
1926	7		8	11	24	30	28	24	12	8	5	5	2	3	2	1

Both new and old lacerations have been repaired immediately or within a few days with little additional danger to the mother (Table IV). Contrary to general belief the tissues can be easily recognized, and lochia, edema and operative deliveries do not seem to interfere with the results of the repair (Table V). In our experience subsequent deliveries are not complicated by previous repairs. If new lacerations occur they are treated like primary lacerations. The patient's stay in the hospital is not greatly prolonged (Table VI). The technic indications and contraindications have been fully described in my previous articles.<sup>1</sup> The types of operations performed are shown in Table VII. Table VIII shows the temperature of cases operated during 1926. Complications that occurred in the same year are shown in Table IX.

TABLE IV. TIME OF REPAIR OF OLD LACERATIONS AFTER DELIVERIES

YEAR	IMMEDIATELY	NEXT DAY	3RD DAY	4TH DAY	5TH DAY	6TH DAY	7TH DAY	8TH DAY	9TH DAY	10TH DAY	11TH DAY	12TH DAY	13TH DAY	14TH DAY	TOTAL CASES
1922	156	1	1	4	2	4	1								169
1923	119	2	11	5	15	3	2	3							161
1924	167	2	8	13	13	1	1							1	207
1925	129	5	3	10	3		7	4							162
1926	152		4	4	5	2	4		1	1					173
Total	723	10	27	36	38	10	15	7	1	1	3			1	872

TABLE VII. TYPES OF OPERATIONS

YEAR	C	T	P	H	TP	TC	TCP	TPH	TPU	TCH	TCPH	CPH	CP	ACP	ACPH	AC	PH	AMP C P
1922		29	43	3	71	1	7	4				1	10					
1923	1	25	47	2	53	1	11	1	1	1	6	3	4	3	2		1	
1924	1	26	43	8	79	2	20	9		3	5	4	1	2	1	1	2	
1925		20	58	7	45	1	10	9			1		8				3	
1926	4	16	63	9	47		7	3			5	1	8	1			8	1

C., Cystocele. T., Trachelorrhaphy. P., Perineorrhaphy. H., H-morrhoidectomy. AC., Partial amputation of cervix. U., Umbilical hernia.  
AMP. C., Total amputation of cervix.

TABLE VIII. TEMPERATURE CHART FOR 1926  
127 OR 71.6% OF THE 173 CASES RAN AN AFEBRILE COURSE, I.E., BELOW 100° F.

100° or over No. of days	No. of cases
1	11
2	6
3	2
4	2
5	2
6	1
7	5
9	4
10	11
13	1
43*	1

\*Died.

TABLE IX. COMPLICATIONS IN 1926

	NO. OF CASES
Shock	3
*Severe bleeding	3
Bronchopneumonia	1
Aspiration during anesthesia	1
Bronchitis	1
Cystitis	3
Cystopyelitis	8
Parametritis	2
Edema of vulva	1
Slough of perineum	2
Retained blood clot	2
†Septicemia	1

\*One patient had a partial placenta previa and was transfused the next day.

†Died.

In the series of 1019 cases there were two deaths one of which was reported in my last paper.<sup>2</sup> The history of the second case is as follows:

Mrs. K. W., aged forty-two years, para vi, was admitted to the obstetric service on April 16, 1926. Examination on admission showed the fetus in a transverse position, the membranes ruptured and the cervix two fingerbreadths dilated. April 17 at 2 A.M., the head was still unengaged. Version and extraction were done and an eleven-pound child was delivered after forty hours of labor. Three days later, the patient was taken to the operation room and a badly lacerated cervix, a marked cystocele and rectocele were repaired. Considerable hemorrhage took place, necessitating much suturing and prolonged anesthesia. April 22 to 24, the patient complained of weakness, headache and chills. She had a septic temperature ranging from 100° to 104° F. On May 11 vaginal incision and drainage were done. On May 15 an abscess of the right vaginal vault was incised and thick, creamy pus was evacuated. May 18 the patient was transfused. She still had a septic temperature, was drowsy, weak and delirious. Blood culture on May 27 showed a *Streptococcus hemolyticus* infection present. Vaginal examination showed no masses in the pelvis. Two days later, the patient died from a septic bronchopneumonia.

I am now preparing a report on the findings six weeks to five years after operation. Most of the patients volunteered the information that

their general health was much improved and that conjugal relations were much more satisfactory since their operations.

### CONCLUSIONS

After ten years of experience, with over 1000 cases operated upon at Mt. Sinai Hospital of Cleveland, the following conclusions may be drawn.

1. The obstetric case should be given the same consideration as major surgery.

2. The presence of lochia, edema, and operative deliveries are not contraindications, neither do they interfere with the performance and results of the repairs.

3. Most of these women leave the hospital in better physical condition and are able to resume their domestic obligations with renewed vigor and vitality.

### REFERENCES

(1) *Bubis*: Ohio State Med. Jour., January, 1919; *ibid.*, May, 1920; *ibid.*, April, 1923; AM. JOUR. OBST. AND GYNEC., August, 1925, x, No. 2. (2) *Bubis*: Ohio State Med. Jour., June, 1927.

7016 EUCLID AVENUE.

(For discussion, see page 131.)

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## THE OLSHAUSEN OPERATION FOR RETROVERSION OF THE UTERUS\*

### A COMPARATIVE STUDY OF ANATOMIC END-RESULTS

BY DAVID NYE BARROWS, M.D., F.A.C.S., NEW YORK, N. Y.

(From the Gynecological Department of the New York University and Bellevue Hospital Medical College)

IN REVIEWING the results of operations for retroversion of the uterus performed in the Gynecologic Service of Bellevue Hospital, it was found that the method described many years ago by Olshausen had been employed more frequently than any other during the past seven years.

This has been only one of a number of types of operation in use there for this purpose during this time, and no one of the eight operators has confined himself to any single type of procedure, all varying the methods employed according to the case in hand.

To better gauge these results, a comparison has been made with those cases in which two other standard and popular procedures have been employed, namely, the Simpson-Montgomery and the Webster-

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\*Read (by invitation) at a meeting of the New York Obstetrical Society, December 13, 1927.

Baldy. These two were selected as they proved to be the next most frequently recorded for this period.

No set rules have existed regulating the choice of operation, but in general the Webster-Baldy was employed where additional ovarian support was required or the abdominal wall afforded poor support, the Olshausen where it was desired to draw the fundus near some particular level on the abdominal wall, and the latter or the Simpson-Montgomery where the ligaments seemed particularly slender near the distal end. In cases where speed was an important factor, to finish a prolonged procedure, the Olshausen operation was frequently used. However, we never use it with a flabby abdominal wall as it is absolutely essential to attach the ligaments to a firm point. If not, the displacement may recur as the abdominal wall sags without any weakness in the ligamentous attachment.

The chief protagonist of the Olshausen operation in this country is Graves, who has used it for about twelve years with complete satisfaction, and who reports practically perfect results with little or no morbidity. His follow-up on 746 out of 1370 cases showed but six failures at examinations made from two months to eight years after operation; three occurred postpartum, two on the cervical stump in prolapse, and one on a case which had suffered a recurrence after a previous operation for retrodisplacement.

Whereas our preliminary investigations did not reveal results as good as he describes, we agree with his pronouncement that it is the simplest and most rapidly performed of all operations now in use for reposition of the uterus, and that its permanence may be compared favorably with other popular procedures.

Its obvious simplicity, eliminating as it does delay due to more or less protracted anatomic dissections, makes it extremely useful as a component part of a prolonged operation, and the absence of injury to surrounding tissues, with accompanying hematomas, trauma, etc., decreases the ensuing morbidity. We also find it extremely useful as an aid in the cure of cystocele.

The frequently mentioned danger of intestinal obstruction and of dystocia must be inappreciable. We have seen none, nor has Graves. The one serious drawback, the silk ligature, it seems universally agreed, is absolutely essential for a successful result. He reported fifteen cases where one silk stitch became infected, requiring removal in only six cases. In seven of our series of 571, which behaved similarly, the silk was removed in only one, several others undoubtedly having the silk slough unobserved.

However, in three cases undergoing a subsequent laparotomy, one ligament has been found to have pulled away from the abdominal

wall and to be attached to the wall merely by a slender cord of peritoneum, 3 to 8 cm. in length.

Our technic is practically identical with that described in the textbooks. Grasping the round ligament gently with an artery forcep to traumatise merely the peritoneum at a point from one to two centimeters from the uterine attachment, the entire thickness of the ligament is picked up on a round curved needle, threaded with number seven braided silk (double). Each stitch is then passed out through the peritoneum, muscle, and aponeurosis at points two or three centimeters to either side of the midline, and after embracing a small bite of these structures, is passed back through the abdominal wall to a point less than one centimeter from its point of exit. Each double ligature is then tied tight, fastening the ligaments snugly against the parietal peritoneum, the knots within the abdomen, and the ends are then cut short. By using the braided silk ligature doubled, one is able by tension in tying the knot to cause sufficient application of the round ligament to the solid structures of the abdominal wall without serious trauma to the ligament or danger of cutting through its muscular tissue. This matter of not tying the suture tight enough to cut through the structures of the ligament early or late, we consider of great importance and believe we avoid many failures for this reason. The distance from the symphysis pubis of this stitch is varied to accord with the inclination desired for the fundus uteri.

In three cases, at subsequent laparotomy done from eighteen months to two and a half years after the Olshausen, no silk has been found.

To compare our results, we have collected 109 out of 135 Webster-Baldy operations and 164 out of 211 in which the procedure described by Simpson and Montgomery was used, as these were done by the same operators who performed the Olshausen operations.

In figuring the percentages, we have classed as failures all cases reported as "fair," "retrocessed," and all degrees of retroversion, to make the statistics as exact as possible. Pain at the site of ligature, so frequently noted in other types of fixation of the round ligament to the abdominal wall, we have found practically nonexistent.

We feel that the grade of intelligence and the social position of our patients probably rank as low as any in the country, so that the presumable amount of postabortal and postpartum care is minimal, and that their convalescent care is practically nonexistent. For that reason, these cases ought to test the efficacy of the operations to the utmost. Under better supervision, many of the poor results would undoubtedly have proved avoidable.

TABLE I. THE RESULTS OF THE WEBSTER-BALDY OPERATION, JAN. 1, 1919 TO JAN 1, 1927

(109 followed up out of 135 done)

POSTOP.	UP TO 1 YR.	1-3 YR.	3-5 YR.	5-7 YR.
Excellent Position	51	27	5	13
Fair	4	0	0	0
Retrocessed	1	1	0	1
Retroverted	3	3	0	0
Excellent—88%				



TABLE II. THE RESULTS OF THE MONTGOMERY-SIMPSON OPERATION, JAN. 1, 1919 TO JAN. 1, 1927

(164 followed up out of 211 done)

POSTOP.	UP TO 1 YR.	1-3 YR.	3-5 YR.	5-7 YR.
Excellent Position	86	35	11	23
Fair	3	1	1	0
Retrocessed	1	0	1	0
Retroverted	1	3	0	0
Excellent—93%				

TABLE III. OLSHAUSEN OPERATION, JAN. 1, 1919 TO JAN. 1, 1927

(432 followed up out of 571 done)

POSTOP.	UP TO 1 YR.	1-3 YR.	3-5 YR.	5-7 YR.
Excellent Position	321	52	23	5
Fair	10	5	0	1
Retrocessed	4	0	2	0
Retroverted	7	4	1	0
Excellent—92%				

The percentage of 92 excellent anatomic results compares favorably with the Webster-Baldy, 88 per cent and the Montgomery-Simpson 93 per cent.

TABLE V. OTHER PROCEDURES ACCOMPANYING RETROVERSION OPERATION

	MONTGOMERY-SIMPSON (211)	WEBSTER-BALDY (135)	OLSHAUSEN (571)
Anterior Colporrhaphy			
Perineorrhaphy			
Cervical Repair	19	13	35
Perineorrhaphy			
Cervical Repair			
Appendectomy	39	33	73
Perineorrhaphy			
Cervical Repair	3	3	0
Perineorrhaphy			
Appendectomy	30	5	26

TABLE VI. OTHER PROCEDURES ACCOMPANYING RETROVERSION OPERATION

	MONTGOMERY-SIMPSON (211)	WEBSTER-BALDY (135)	OLSHAUSEN (571)
Cervical Repair			
Appendectomy	13	12	92
Operation on tube or ovary			
Appendectomy	19	17	112
Appendectomy	20	12	61
Insertion of stem pessary	0	1	7
Uterosacral ligaments shortened	12	2	10

In very few cases (about 16) was the retroversion operation the only procedure done. We have found it extremely useful in helping to support a cystocele case, and also as the final step in a difficult adnexal case, when we wish to prevent adhesions forming with the uterus in retroversion.

TABLE VII. EFFECT OF PREGNANCY

	WEBSTER-BALDY	MONTGOMERY-SIMPSON	OLSHAUSEN
Good after abortion	7	3	3
Good after delivery at term	5	6	10
Poor after abortion	1	0	3
Poor after delivery at term	0	0	0
Percentage good	92%	100%	81%

Unfortunately, many of our cases are delivered under conditions where it is not possible to get any postpartum care or a record of the findings.

It is possible that the cases that have Webster-Baldy and Montgomery-Simpson operations need less postabortal and postpartum care than the Olshausen's, but unfortunately our statistics do not cover enough cases to prove it. The averages, however, are approximately the same.

TABLE VIII. COMPLICATIONS WITH OLSHAUSEN OPERATION IN 571 CASES, JAN. 1, 1919 TO JAN. 1, 1927

Infected wounds	7
Silk removed	1
One round ligament pulled away from abdominal wall	3
Sinus in abdominal incision (4½ yr.)	1
Potential hernia near site of knot	2

So far, the only complications that have been noted are listed here. The cases where the ligaments pulled away were some of the earlier ones, and at that time we were in the habit of tying the silk extremely tight. This, we now feel, may impair the muscular structures of the round ligament to such an extent that the peritoneum is the sole remaining support, and for that reason we now attempt to avoid crushing the ligament by clamp or tie.

The case with the sinus has had an old syphilitic infection of a very obstinate type, which was neglected for a number of years after infection. She has recently been operated upon but has not reported since operation.

The potential herniae were rather wide relaxed areas in the aponeurosis and rather indicated that too wide a bite of this structure had been embraced by the silk ligature.

Of those cases with potential or actual prolapsus, necessitating repair of anterior vaginal wall, perineum or both, 91 had Simpson-Montgomery which is 55 per cent, 54 or 49 per cent had Webster-Baldy, and 132 or 30 per cent had the Olshausen operation performed. Seven in the last named group and one in the first had a stem pessary inserted for dysmenorrhea and an old complete laceration of the perineum was repaired in two cases. This latter we have since ceased to do with any coincident procedure.

In one case in which a Webster-Baldy was not satisfactory, an Olshausen was done at the same sitting. In another which failed after ten months, a Simpson-Montgomery was done at a subsequent operation.

Of these cases of Olshausen operations only one was done on the stump of the cervix after hysterectomy, a procedure which has proved very useful in other clinics.

#### SUMMARY AND CONCLUSIONS

1. Our results with the Olshausen operation compare favorably with those we have obtained with the Webster-Baldy and Simpson-Montgomery procedures.

2. Pregnancy, whether terminating at full term or prematurely, has proved there is little choice between the three methods.

3. Intestinal obstruction following the Olshausen operation is rare.

4. The silk ligature seldom causes trouble.

5. The ease and rapidity of accomplishment recommend the Olshausen operation, as well as the absence of unnecessary trauma to adjacent structures.

130 EAST FIFTY-SIXTH STREET.

(For discussion, see page 123.)

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#### FETAL MORTALITIES\*

AN ANALYTICAL STUDY BASED ON TWO YEARS' RECORDS (1925-1926) AT  
HARPER HOSPITAL

BY GEORGE KAMPERMAN, M.D., F.A.C.S., DETROIT, MICH.

FETAL mortality is an all absorbing topic to the obstetrician, and because of this realization we believe that the record of the fetal mortalities at Harper Hospital during 1925 and 1926 will be of some interest to the members of this society. It is not our aim to pare down our mortality figures by deducting certain cases for which no one need share responsibility. In fact we aim not simply to consider deaths for which an individual may be responsible, but would rather consider fetal deaths as they actually occur and if possible by analysis to show where there is opportunity for improvement. We wish to present to you the work of the hospital group, with our results. We frankly offer you the facts, and we invite your cooperation by your criticism, analysis, and discussion.

This record of fetal deaths includes all deaths of the fetus that occurred during the maternal stay in the hospital. As all pregnancies of five or more months are cared for in the obstetric division, the fetal deaths include many very premature fetuses. During these two years the total births numbered 2478, and 163 fetal deaths are recorded, a fetal mortality of 6.65 per cent. But this record includes no

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\*Read at a meeting of the Detroit Obstetrical and Gynecological Society, February 7, 1927.

cases prior to five months. If one could estimate the number of miscarriages that occur before five months, it would then show us the appalling number of fetal deaths that really do occur. Such figures would be mere conjecture on our part, yet it is easy to infer that the actual loss of fetal life is far greater than the mortality percentage as shown in any hospital report.

In trying to analyze the causes of fetal death we have grouped the cases in three major groups: (1) Fetal death before viability; (2) Borderline cases, or in other words, premature infants which although premature had a prospect of surviving; (3) Full term, or practically full-term infants.

We would like to interject just a word here as to what constitutes viability, as interpreted in this series. After a careful study of each record a fetus that was frankly not of seven months development and did not weigh 1500 grams or  $3\frac{1}{8}$  pounds was considered as nonviable. We believe that weight is not the only criterion, as a full-term baby of small weight does not present as great a problem as a premature baby of the same weight.

#### FETAL DEATHS PRIOR TO VIABILITY

Among these 2478 births there are recorded 63 deaths of nonviable fetus, a mortality in this group of 2.54 per cent. The tabulated matter (Group I) shows the classification of the causes of these deaths.

##### GROUP I

Nephritic toxemia	22	
Unknown	24	
Placental bleeding	7	
Congenital malformations	3	
Maternal toxemia, not nephritic or eclamptic	2	
Maternal cardiac decompensation	1	
Maternal overexertion	1	
Previous amputation of cervix	1	
Maternal pneumonia	1	
Syphilis	1	
Total	63	-2.54 per cent of entire series.

On reviewing this group it will be seen that in about one-third of these cases the cause of death is unknown. These 24 cases of unknown fetal death include eight twins (4 pairs). In these cases no maternal cause for the early onset of labor could be found. By this we mean that these mothers had normal urines, normal blood pressures, negative Wassermanns, and were apparently free from any physical condition which is known to be a factor in causing premature labor. Since intrinsic disease of the ovum is recognized as a possible cause of miscarriage, it is possible that some of these might fall in that group. Probably some were syphilitic; but that is mere conjecture which can neither be proved nor disproved.

The most common known cause of fetal death at this series is nephritic toxemia. Twenty-two cases are classified under this heading, about one-third of the entire series of deaths of nonviable fetus. This large proportion of cases emphasizes the importance of nephritis as a cause of fetal death. In a rather large percentage of these cases the mother had been in the hospital under observation and treatment for some time before the fetal death occurred. In this group the number of stillbirths was about equal in frequency to those that survived a short time. About one-half of the stillbirths were macerated, or one-fourth of all those that died because of maternal nephritis.

Seven fetal deaths in this series were associated with placental hemorrhage. A careful analysis of these seven cases would lead us to list four of these as being placenta previa, and three as abruptio placentae. In all these cases bleeding had been a prominent symptom for considerable time before the fetal birth. In two of the cases of placenta previa the premature birth was perhaps definitely precipitated by the insertion of a bag to control the bleeding.

Three fetal deaths are ascribed to fetal malformation. These were cases of acrania with spina bifida.

Two fetal deaths occurred because of maternal toxemia other than nephritis. One of these was a general septicemia of unknown origin and the other was an unusual case of toxic vomiting of pregnancy.

We realize that the incidence of these conditions is peculiar to this small series. This is particularly emphasized by the recording of only one case of fetal death from syphilis in the entire series.

#### FETAL DEATHS AMONG THOSE PREMATURE, BUT VIABLE

This small series represents a few borderline cases which, although premature, had a fair prospect of surviving. This group contains 22 cases, or 0.88 per cent of the entire number of births during the two years. Group II will show the classification of the cases in this series.

#### GROUP II

Nephritic toxemia	6
Unknown	5
Placental bleeding	5
Eclampsia	2
Fetal malformation	2
Toxic vomiting	1
Accidental rupture of membranes	1
Total	22 cases 0.88 per cent of entire series

In this series it will be noted that in five instances the cause of the premature labor was unknown, or in about one-fourth of this series. The largest number of premature births is again ascribed to nephritis, six out of twenty-two. Of these six, one was born macerated. Four were born alive and lived a very short time.

Placental bleeding was the cause of fetal death in 5 cases of this series. Two of these were considered placenta previa, and three were cases of abruptio placentae.

Eclampsia was the cause of fetal death in two of these prematures. In one case the patient had several convulsions while the other was a preeclamptic toxemia.

#### DEATHS AMONG PREMATURES

3.59 per cent of entire series

#### COMBINATION OF GROUPS I AND II

Nephritic Toxemia	28
Unknown	29
Placental bleeding	12
Malformations	5
Eclampsia	2
Other Toxemias	2
Toxic vomiting	1
Rupture of membranes	1
Cardiac disease	1
Overexertion	1
Previous amputation of cervix	1
Pneumonia	1
Syphilis	1
Total	85 cases

If now we combine Groups I and II as above, we find that in both groups nephritic toxemia is the largest known factor in producing fetal deaths in this series, 28 fetal deaths among 85, a total of 33 per cent. Also it will be noted that placental bleeding is the second largest known factor in both groups, 12 fetal deaths among the 85 prematures, a mortality of 14 per cent. Also the 85 deaths in prematures represent a fetal mortality of 3.59 per cent, over half of the total fetal mortality in the entire series of 2478 births.

#### FETAL DEATHS AT FULL TERM

In this third group of cases we list all cases at full term or in the last month of pregnancy. The fetal deaths in this group number 78, a mortality of 3.14 per cent. This group represents about one-half of the fetal mortalities in the entire series. These are all babies that should have had a chance for life, at least as far as their size and period of development was concerned, and the analysis of this group in particular should show us where our obstetric work is probably insufficient. These cases may be classified as Group III.

#### GROUP III

1. Associated with labor and delivery	44
a. Delivery deaths (30 cases)	
Forceps delivery	8
Forceps and version	4
Version	4
Breech extraction	2

Spontaneous labor		
cerebral hemorrhage	6	
cause unknown	3	
Forcep delivery for failing fetal heart	3	
b. Hemorrhage during labor	6	
c. Prolapse of cord	5	
d. Transverse position	1	
e. Face presentation	1	
f. Eclampsia	1	
2. Malformations		13
a. Hydrocephalus with spina bifida	3	
b. Hydrocephalus	2	
c. Atresia of esophagus	1	
d. Atresia of ilium	1	
e. Atresia of bile ducts	1	
f. Brain defect, absence of lobe	1	
g. Congenital goiter	1	
h. Congenital heart, death not at delivery	2	
i. Teratoma of sacrum with spina bifida	1	
3. Nephritic Toxemia		5
4. Intrauterine death prior to labor, cause unknown		4
5. Unknown (atelectasis?)		1
6. Adrenal hemorrhage		1
7. Neonatal mortality		6
a. Melena neonatorum	3	
b. Suppurative stomatitis	1	
c. Enlarged thymus	1	
d. Erysipelas	1	
8. Postmaturity		4
Total		<u>78</u>

The most important group here to be considered are those fetal deaths associated with labor or delivery. But before discussing this group, we would like to review briefly the other causes of death in this series and then have all the remaining time for the important group of delivery deaths.

Malformations are credited with thirteen fetal deaths. This group represents the cases that had a gross defect which was incompatible with life. A few cases of congenital heart disease could properly be included here, but they are classified with the labor deaths because death occurred during labor or immediately after delivery, the autopsy showing the cause of death. These gross malformations represent 16 per cent of all deaths at full term and obviously it would be impossible to influence this mortality in any way. They are of interest chiefly in the explanation of their occurrence and not from the prophylactic standpoint. These malformations can be classified as follows:

Hydrocephalus with spina bifida	3 cases
Hydrocephalus	2
Atresia of esophagus	1
Atresia of ileum	1
Atresia of bile ducts	1
Brain defect, absence of lobe	1
Congenital goiter	1
Congenital heart	2
(Death not at delivery)	
Teratoma of sacrum with spina bifida	1
Total	<u>13 cases</u>

Nephritic toxemia in this group is represented by 5 fetal deaths, a percentage of 6.4 of the full-term fetal deaths. These are not labor deaths, but occurred before the onset of labor. Deaths among nephritics occurring during labor and delivery will be classified elsewhere.

Among these full-term deaths are four fetal deaths occurring intra-uterine without any known cause. In these cases no maternal or fetal cause was ever found. These deaths all occurred before onset of labor and fetal death was definitely diagnosed in each case.

One postnatal death is classified as from unknown cause. From the clinical record one could perhaps call it an atelectasis, but this could not be given as a positive diagnosis.

One death is recorded as being due to adrenal hemorrhage. This was a postnatal death occurring three days after delivery. During labor the fetal heart had been somewhat alarmingly irregular and a low forcep delivery was performed because of the cardiac irregularity. The delivery was easy and the baby seemed vigorous and normal and nursed well. On the third day the baby's condition suddenly changed and the baby appeared to be in collapse. Autopsy showed a normal heart. The adrenals were hemorrhagic in appearance, and in the opinion of the pathologist were the cause of death. The cause of adrenal hemorrhage is unknown. The autopsy showed no other cause of death.

This series shows six neonatal deaths. The causes of death are given as follows:

Melena neonatorum	3 cases
Enlarged thymus	1
Erysipelas	1
Suppurative stomatitis	1

The suppurative stomatitis occurred in a baby born easily and spontaneously and first began on the seventh day postpartum. This began with a swelling of jaw and neck, associated with fever. The infection spread to the mediastinum and was fatal in two days. The attending pediatrician was of the opinion that the baby had been infected by the breast milk. Extensive cultures of breast milk showed only staphylococcus, while the baby's infection was a streptococcus. The mother was given an extensive examination for focal infections. She had a mild streptococcus tonsil infection and since her delivery her tonsils have been removed in the hope of preventing another such fetal death. This patient has two living children.

The four deaths ascribed to postmaturity were four cases that apparently went about a month beyond the estimated date and in these cases fetal death occurred before the onset of labor. No other cause of the fetal deaths could be found, and they are classified as being due to postmaturity. In a personal communication from Dr. DeLee he states that he considers postmaturity as a definite cause of fetal death.



Usually, however, it is my habit not to take going beyond the estimated date as anything very serious and, as a rule, wait for labor to start spontaneously regardless of the number of days overdue.\*

## SUMMARY

CAUSES OF FETAL DEATHS IN ENTIRE SERIES. 2478 BIRTHS, 163 DEATHS,  
6.65 PER CENT

	NONVIABLE	PREMATURE	FULL TERM	TOTAL	PER CENT
Unknown	24	5	8	37	22.7
Nephritic toxemia	22	6	5	33	20.2
Placental bleeding	7	5	6	18	11.0
Malformations	3	2	13	18	11.0
Delivery deaths			18	18	11.0
Labor deaths			11	11	6.7
Prolapse of cord			5	5	3.0
Neonatal deaths			6	6	3.6
Postmaturity			4	4	2.4
Adrenal hemorrhage			1	1	0.6
Eclampsia		2	1	3	1.8
Toxic vomiting		1		1	0.6
Accidental rupture of membranes		1		1	0.6
Toxemia, unclassified	2			2	1.2
Cardiac decompensation	1			1	0.6
Overexertion	1			1	0.6
Amputation of cervix	1			1	0.6
Pneumonia	1			1	0.6
Syphilis	1			1	0.6
Total				163	

1807 DAVID WHITNEY BUILDING.

\*The detailed case histories will be found in the author's reprints.

# THE PRESENT STATUS OF THE ERGOT QUESTION, WITH PARTICULAR REFERENCE TO THE PREPARATIONS USED IN OBSTETRICS AND GYNECOLOGY

BY ERWIN E. NELSON, PH.D., M.D., AND GEORGE L. PATTEE, A.B.\*  
ANN ARBOR

*(From the Department of Materia Medica and Therapeutics, University of Michigan Medical School)*

RECENT work bearing on the composition of ergot and the action of the substances therein present makes a consideration of the preparations of this drug upon the American market, and their use, of considerable importance.

According to current views there are present in ergot, two groups of active substances: the alkaloids, crystalline ergotinine (1), amorphous ergotinine, otherwise known as ergotoxine (2) or hydroergotinine (3), ergotamine and its isomer ergotaminine (4); and the amines, of which histamine and tyramine only seem to be of particular importance from either the pharmacologic or the clinical standpoint.

Ergotinine has been found to be a relatively inactive substance, the early reports ascribing to it considerable activity, not all, as pointed out by Barger and Dale<sup>5</sup> being based on the use of pure specimens of the alkaloid. Kobert<sup>6</sup> using a pure specimen found it almost entirely without activity, and more recent reports show that while it does have some pharmacodynamic properties these are relatively weak as compared with the other active materials. For example it has about one three-hundredth the strength of ergotamine judged by its action in paralyzing the renal vasomotors<sup>8</sup> and about one five-hundredth the stimulant action of the same drug upon the isolated guinea pig uterus.<sup>7,4</sup> Ergotoxine, as the amorphous ergotinine is best known, has a much more marked activity. Among its pharmacologic actions are those of producing the characteristic bluing and gangrene of the cock's comb, the stimulation of the excised uterus (rat, cat, guinea pig) as well as that in situ (cat, rabbit, monkey), and the well-known vasomotor reversal, due to paralysis of the motor sympathetic fibers.<sup>9</sup> Of the other alkaloids, the only statement regarding ergotaminine seems to be that of Spiro<sup>4</sup> that it falls between histamine and ergotamine in its action in the excised uterus, having more effect on the tone than the frequency of contractions, and that it is relatively nontoxic, 3 milligrams having been without effect on a 440 gram guinea pig.

Since the isolation of ergotamine an extensive literature has appeared both on its pharmacology and its clinical use.<sup>10</sup> Although it is clearly different in its physical and chemical properties from ergotoxine, the two substances seem closely allied as to their pharmacodynamic activity. Dale and Spiro<sup>11</sup> stated that qualitatively they were equal and the quantitative differences were slight, so that for practical purposes the two substances might be said to be the same. Although further work has not altogether confirmed this view, the differences are of academic rather than clinical importance at this time. The most important action ergotamine

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possesses from the standpoint of its use is that of stimulating both tone and contractions of the uterus. For example, the excised uterus of the virgin guinea pig is stimulated when the alkaloid is present in the surrounding bath in a concentration of 1:125,000,000.<sup>11</sup> The isolated uteri of the rat and cat and that of the rabbit in situ also are stimulated. Small doses may be repeated, while after one large dose, further administration is ineffective. The contraction of the excised uterus is not so prompt as that from histamine, but is more persistent, and it is more difficult to restore the uterus to its previous state of activity by washing out the drug than is the case after histamine.

Of the amines present only two have activity sufficient or have been shown to be present in amounts adequate to possess any important share in the action of ergot on the uterus. These are tyramine and histamine, which are in no sense specific to this drug. Indeed it has not been established that they occur in perfectly fresh crude ergot and according to Spiro and Stoll<sup>4</sup> their presence is inconstant. They are, however, usually present in the galenical preparations, and the pharmacologic activity of these preparations may be due to them to a considerable degree. Broom and Clark<sup>14</sup> have shown for example, that the action of the B. P. Liquid Extract is due almost entirely to the amines present, and the U. S. P. Fluid Extract seemed to have about equal amounts (judged by activity) of the two groups, alkaloids and amines. Forst and Weese<sup>13</sup> found in different preparations of ergot, that histamine was present in quantities varying from traces up to 0.4 mg. per cubic centimeter of finished product.

The relative activity of these two substances is very different. Tyramine causes a rise in blood pressure, histamine a fall (in carnivorous animals and man). Tyramine has less than one two-hundredth the activity of histamine on the excised uterus. Though no statement of the relative amounts of the two substances present in ergot preparations is available, it is usually accepted that more activity may be ascribed to the histamine present than to the tyramine.

The task of evaluating clinical reports on the merits of ergot as such or of any of its constituents is difficult for several reasons. Ergot varies in strength as collected and then may lose a part of its activity before being prepared for use. The preparations when made do not necessarily contain the active materials. In general, preparations made by use of water as an extracting agent contain chiefly amines, while preparations made by a method using acid-alcohol, such as that outlined by the U. S. P. for the fluid extract, are rich in alkaloids, provided of course that these were present in the crude drug in sufficient amount. This difference in preparations was noted long ago by Barger and Dale<sup>5</sup> and Cushny<sup>14</sup> and recently verified by Broom and Clark<sup>12</sup> while further confirmation is offered in the present paper. A negative clinical result may be due to the use of an inactive preparation. Finally it is very difficult for the obstetrician to say that adequate and maintained contraction of the uterus following delivery is due to the activity of a drug, or drugs, he may have given or to the natural tendency of the uterine muscle itself.

Not a great deal has been written about the clinical action of the ergot preparations (other than the individual constituents) in recent years, but if one may judge by the statements in the standard textbooks of obstetrics or gynecology, it is used in this country chiefly to prevent postpartum hemorrhage, or to contract atonic uteri after delivery. To a lesser extent it seems to be used against various types of bleeding of gynecologic origin, such as that from myomas of the uterus. Practically all American authorities deprecate strongly its use during labor, or before the delivery of the placenta. The use to

prevent hemorrhage after abortion or curettage is entirely analogous from the standpoint of mechanism to its use to prevent postpartum hemorrhage. The use during the puerperal period, to hasten involution, is somewhat different, and in the light of the work of Bourne and Burn (cited below) perhaps not so important as usually considered. In the discussion of the use of ergot in textbooks no recognition of a possible difference in action of the different preparations has been made. In the literature here discussed, only reports in which it has been possible to determine the type of preparation used have been included.

Although ergotoxine was for some considerable time available for medical use, very few reports on its action have appeared. Sharp<sup>15</sup> found its action when injected similar to that of ergot, more prompt but more evanescent. Kehrer<sup>16</sup> found that injection of 1 to 2 milligrams was ineffective. In 1923 the statement was made in the British Codex that "Ergotoxine has been used clinically for its action on the uterus, but it is disappointing, and gynecologists are now generally agreed that it is not the active constituent of ergot they want."

The shortage and high cost of ergot during and after the war led in Europe to many attempts at using synthetic ergot substitutes, chiefly histamine, tyramine or both in combination. Using tyramine alone, Heimann and Abel found it a complete substitute for ergot, without the toxicity of the latter.<sup>18</sup> Sharp,<sup>15</sup> Kehrer<sup>16</sup> and Bourne and Burn<sup>17</sup> obtained only negative results from its use. Barbour's<sup>19</sup> successful results were obtained with quantities very much larger than occur in therapeutic doses of ergot.

Histamine alone was tried by Koch,<sup>20</sup> Jäger,<sup>21</sup> Kehrer<sup>16</sup> and Bourne and Burn.<sup>17</sup> The first author used one milligram hypodermically, during labor, and found that it stimulated the pains when they were weak. Jäger obtained similar results, if adequate doses were given (8 mg. injected), but noted unpleasant side effects, flushing, erythema, and headache. Kehrer (1 to 2 mg. injected) did not confirm the finding of uterine stimulation, recording the contractions graphically by means of a balloon in the uterine cavity connected to a manometer, but saw even more marked symptoms, including respiratory disturbances and clonic spasms.

More frequently than either of the amines alone, there was used a mixture of the two, usually containing 0.000,125 gm. histamine and 0.0065 gm. tyramine.<sup>21</sup> Inasmuch as it has been shown that the strength of histamine is some five to fifteen hundred times greater on the isolated uterus than that of tyramine,<sup>22</sup> the probabilities are that in this preparation in which the amount of tyramine is only fifty times that of the histamine, the activity is almost wholly due to the histamine. Jäger gave this preparation to 250 patients for the pre-

vention of postpartum hemorrhage, with eight failures. He lists 150 additional cases from the literature, with ten failures. It was also used to prevent hemorrhage following spontaneous or instrumental abortion. Kosminski<sup>21</sup> and Jäger also found it of some value in the treatment of bleeding from gynecologic causes, as from myomas of the uterus. The drug was always administered by subcutaneous or intramuscular injection, a warning being given against its intravenous administration. Rübsamen, Wasicky, Hoffmann,<sup>23</sup> however, found the action too fleeting to be of value.

A consideration, aside from the negative clinical results, making one disinclined to ascribe to histamine or tyramine any important share in the action of ergot, is the evidence from a number of sources that these amines are not active when taken by mouth, whereas ergot will produce its effects irrespective of the route of administration.

While the literature of the use of ergotoxine is very limited (*vide supra*), since the isolation of ergotamine in 1922 a large number of papers have appeared dealing with its use, chiefly to prevent or control postpartum hemorrhage from atonic uteri.<sup>24</sup> Other indications are retained lochia, delayed involution, prevention of bleeding in cesarean section, treatment of bleeding from abortion, either spontaneous or following instrumental emptying of the uterus. In the treatment of incomplete abortion with retention of placental rests, only Turoid reports good results. In general all authors speak strongly against its use during labor, as a number of cases of tetanic contraction of the uterus, with asphyxia of the child, have occurred following this use. Schnitzer<sup>26</sup> speaks especially strongly against this practice, even with the use of small doses, and holds that the manufacturer should indicate on the container that it is not to be used in this way. Kopischke<sup>27</sup> and Turoid<sup>25</sup> failed to induce abortion with ergotamine. Hellmann<sup>28</sup> found that ergotamine facilitated curettage by rendering the uterus firm. Although Wetterwald<sup>29</sup> gave single doses of 0.5 milligram intravenously (with unpleasant symptoms in 30 per cent of his cases), practically all writers have given it either intramuscularly or subcutaneously, or during the puerperium or for gynecologic bleeding, by mouth. The unpleasant side effects are most often seen in gynecologic practice, during the puerperal period, or when given after instrumental abortion. These are reported as occurring in varying degree, depending in part on the dose and route of administration, and in part it is said on the stability of the nervous system of the individual. Nausea and vomiting, persistent headaches, cyanosis, muscle pains, and rarely collapse have been observed. For some unexplained reason, when given postpartum, other symptoms are rarely noted. Kopischke<sup>27</sup> advises against its use in ambulatory patients, confining it to hospital practice, and in this, Lützenkirchen<sup>30</sup> concurs. The gynecologic uses are not so clear-cut as those following childbirth. It has

been recommended for metrorrhagia of various forms, climacteric, from myomas, etc. For this use it has been given orally. Such use must be carefully guarded, as Panter<sup>31</sup> has reported a case of production of a tabetic condition after five milligrams in three days, and Carreras<sup>32</sup> a fatal case of gangrene of the feet after a total of approximately four milligrams, orally, through one week.

Recently Bourne and Burn<sup>17</sup> in a short series of experiments have examined the action of histamine, tyramine, and ergotamine intrapartum, recording the uterine contractions by means of a balloon in the uterine cavity attached to a recording manometer. Tyramine (10 mg.) injected produced only a single contraction. Histamine (2 mg.) produced a powerful but short-lived stimulation, followed apparently by uterine exhaustion. Ergotamine, however (1 mg. injected), produced a powerful contraction of the uterus, lasting sixteen hours. Such an action of course would contraindicate its use during labor, but would make it of considerable value to maintain uterine contraction after delivery of the placenta.

Bourne and Burn also carried out another experiment which throws some interesting light on the use of ergot preparations during the puerperium. Three preparations were administered to a series of normal patients during the puerperium. Of these one was an ergot preparation known to be rich in the active alkaloids, one a practically inert preparation of ergot and the third a preparation of inert substances made up to resemble the other two. Two of these were administered to two series of twelve patients each, and the third to a series of eight. Observations were made daily as to the height of the uterus above the symphysis, and the color and amount of the lochial discharge. At the end of the week it was impossible to tell which patients had received the active ergot and which either of the other materials. Such results make one suspicious of all claims made for the value of any type of ergot preparation during the puerperium, but of course have no bearing on the action postpartum.

The literature on the use of ergotamine has been discussed in detail, because here for the first time is a substance which seems to have all of the effects which are usually held to be characteristic of ergot. On the other hand the evidence for the value of tyramine and ergotoxine in obstetrics or gynecology is lacking, and that for histamine is questionable. Whether or not these four substances represent the entire activity of ergot is not yet established. Halphen<sup>33</sup> believes that they do not. At any rate, of the substances thus far isolated, ergotamine seems to have had the most extensive clinical trial, and apparently will do all that ergot will do.

If this be correct, then it becomes pertinent to reexamine the preparations of ergot which are available to the physician. The pharmacologist and chemist seem to be in agreement as to the active constitu-

ents of ergot, and such clinical results as are available offer corroboration of their view. Then it should be made certain that preparations containing the active materials are available, and only such preparations should be used in the practice of medicine.

In order to throw some light on the relative strength of the ergot preparations now available, a number have been assayed by two biologic methods, no chemical method being available. The U. S. P. X. requires that the official fluid extract shall possess the same activity as an equal amount of the standard fluid extract furnished by the Bureau of Chemistry of the U. S. Department of Agriculture, when tested by the cock's-comb method.

This method in brief consists in determining the amount of the fluid extract being assayed necessary to produce the same degree of bluing of the comb of susceptible white Leghorn cocks as is produced by a standard dose of the standard fluid extract. Details of the method are given in the U. S. P. X. and in the papers of Edmunds and Hale, Gittinger and Munch, and others.<sup>34</sup> This method measures the alkaloids present. It may seem a legitimate question from the clinical standpoint to ask how far such a test actually can measure the therapeutic efficiency of a drug in action upon the human uterus. This, of course, it does not do, but does measure as well as any available method (with the possible exception of the other used in this study) the concentration or amount of the substances to which the therapeutic action is believed to be due. The evidence on this point is clear, for the amines do not produce the characteristic effects on roosters,<sup>35</sup> while the alkaloids not only have this effect but will, if given in large or repeated doses, bring about gangrene of the comb and wattles.<sup>5, 11, 12</sup> Gangrene may also be produced in the tail of the white rat<sup>36</sup> and in one case has been seen in the human extremities, similar to that occurring in chronic ergot poisoning.<sup>32</sup>

The U. S. P. X. method and another recently described have been used in making the assays, the results of which are noted below. The second method is that of Broom and Clark,<sup>12</sup> which also measures the alkaloidal content of ergot. This method as slightly modified consists in suspending two similar strips of the uterus of a parous, but not pregnant, rabbit in Ringer's solution in two similar chambers, under similar conditions of temperature and oxygen supply. The amount of epinephrine necessary to produce a good contraction of each strip is noted, and then the amount of the ergot preparations being compared necessary to produce the same degree of paralysis in the two strips to subsequent similar applications of epinephrine, is determined. This may require the use of several pairs of strips, but with reasonable familiarity with the technic the method yields fairly accurate comparisons, possibly more accurate, especially in the case of weak preparations, than that of the U. S. P. X.

There are a number of other assay methods, two of which are extensively used in this country, but neither of which have sufficient in their favor to justify their use. One consists in determining the stimulant activity of the preparation on the isolated uterus of the virgin guinea pig. There are a number of substances present in galenical preparations, histamine, tyramine, potassium chloride, acetyl-cholin, as well as the alkaloids, all of which will stimulate the isolated uterus, but of these, histamine is the most active, so that such a test measures chiefly the histamine content. A second method consists in determining the amount of ergot preparation necessary to produce a standard rise in blood pressure. This again measures the composite action of all the materials present, some of which are pressor, while others, as histamine, are markedly depressor. There is no way of evaluating accurately the

part played by any one of the constituents under such circumstances. Yet prior to the appearance of the U. S. P. X. apparently about half the men making ergot assays in this country were using this method.

In the present paper, using the cock's-comb method of the U. S. P. X. and the epinephrine reversal method of Broom and Clark, four types of preparations have been assayed. From different specimens of crude ergot different fluid extracts have been made in the laboratory by the U. S. P. X. method. These have been preserved in 10 c.c. ampules in the refrigerator and were from twelve to eighteen months old at the time of assay. A second group consists of U. S. P. fluid extracts purchased on the open market, some in original containers, others as dispensed from the stocks of the local retail druggists. A third group consists of a number of ampule preparations for administration by injection. These were all products of reputable manufacturers, and in several cases made by the same firms as the fluid extracts. Finally one specimen of the extract "Ergotine Bonjean" was examined, though there was no reason to suppose that any alkaloids would be present in it. Judging by the demands for this material on the retail druggist it is not in very extensive use at present, and only one specimen was assayed.

From examination of the table it will be seen that the fluid extracts, both those made in the laboratory and those purchased from the

TABLE I. SHOWING THE COMPARATIVE STRENGTHS OF A NUMBER OF ERGOT PREPARATIONS, ASSAYED BY TWO METHODS

GROUP	NO.	TYPE OF PREPARATION	ASSAY METHOD	
			U. S. P. X.	BROOM-CLARK
A.	1	Standard fluid extract	100%	100%
B.	2	Laboratory fluid extract	200	190
	3	Laboratory fluid extract	150	175-200
	4	Laboratory fluid extract	100	100
C.	5	Commercial fluid extract	Below 25	5-10
	6	Commercial fluid extract	100	100
	7	Commercial fluid extract	100	100
D.	8	Ampoule preparations	Below 25	Below 6
	9	Ampoule preparations	Below 12	Below 2
	10	Ampoule preparations	—	Below 2
	11	Ampoule preparations	Below 10	Below 3
E.	12	Ergotine Bonjean	Below 25	Below 1

Group A. The standard sent out by the U. S. Bureau of Chemistry. B. Fluid extracts made from crude ergot in the laboratory. C. Commercial fluid extracts. D. Commercial preparations, in sterile ampoules, for injection. E. Ergotine Bonjean, a solid extract.

retail druggist were up to or above the standard set by the U. S. P. Only one fluid extract was not of the required strength, and that though made by a reputable manufacturer, had been open on the shelves of the pharmacy for at least six months. Of the hypodermic preparations none possess any important degree of activity by either method. This finding is very important. It seemed to be the opinion of the retail pharmacist that the ampules are more extensively used



than the official preparations, and yet they seem to be almost wholly devoid of activity. A word with respect to the method of reporting the values in the table should be added. An average susceptible cock reacts with the right degree of bluing of the comb to a dose of 0.5 c.c. of the fluid extract per kilogram. If such a cock received 2.0 c.c. per kilogram of the preparation being assayed, and still did not react, no further injections were made in other cocks and the strength was reported merely as less than 25 per cent, although actually there may have been *no* active material present. From this it follows that there is no discrepancy between a value reported as "below 25 per cent" in the table of values by the U. S. P. method and "below 5 per cent" in the values by the other method. The proper interpretation is that the actual value in each case lies somewhere between zero and the percentage given. When actual values are reported (not preceded in the table by "below"), they are in good agreement.

The conclusions to be drawn from the examination of these preparations seem fairly obvious to us. Much of the dissatisfaction with the results from ergot administration has its explanation in the use of preparations which do not contain the active substances. The method of correction lies in the use of either the U. S. P. official preparation properly made and assayed by responsible manufacturers, or preparations of the alkaloids or known to contain them. It is not so easy to understand why the hypodermic preparations are so extensively used, in view of their apparent inactivity. Perhaps one reason is that there are often administered with the ergot, hypodermic preparations of pituitary, which as has been shown elsewhere, are both active and stable. If the action of ergot is desired, preparations should be used which have been shown by the proper type of assay to be active.

It should be stated here that we have felt that nothing would be gained by identifying the different preparations assayed. Where a standard exists, the manufacturers seem to have made a serious effort to comply with it, marketing satisfactory preparations, and the physician can best protect his patient and himself by using such standardized official preparations.

#### SUMMARY

1. The active substances in ergot or its preparations are histamine, tyramine, ergotoxine, and ergotamine.

2. All of these substances will stimulate the isolated uterus, but there is no satisfactory clinical evidence for the value of tyramine or ergotoxine in obstetrics or gynecology; the evidence for histamine is somewhat questionable; adequate clinical as well as experimental evidence exists to justify the conclusion that the alkaloid ergotamine is the most important constituent of ergot, and the one whose presence in ergot preparations should be insured.

3. An examination of a number of the ergot preparations available in the market reveals that only the U. S. P. fluid extracts contain important amounts of the active alkaloids.

4. Only the official fluid extract or preparations definitely shown by proper methods of assay to contain the alkaloids of ergot should be used in medicine.

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# THE RELATION OF GALL BLADDER DISEASE TO PREGNANCY\*

WITH SPECIAL RELATION TO THE FACTOR OF HYPERCHOLESTEROLEMIA

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THE relative frequency of gall bladder disease, and of cholelithiasis naturally demands some thought as to its cause and prevention. It holds a place with the more serious of abdominal diseases, and operations for the relief of gallstones are always attended with considerable apprehension on the part of the surgeon, especially when there is an associated jaundice.

The most frequent cause of symptoms in all gall bladder disease is gallstones, and a study of their cause and prevention entails a study of the pathogenesis of gallstone formation. The following thoughts are in relation to that study.

In reviewing any series of cases of cholelithiasis one is impressed with the high occurrence of the disease in females. In a recent series of 136 operated cases,<sup>1</sup> 82 per cent of them were females. The figures given in the literature generally range from 70 per cent to 80 per cent. This high incidence of the disease leads to the question as to what distinctly female function would predispose to gallstone formation. Pregnancy and the menstrual cycle suggest themselves as the most prominent female characteristics, and these functions must be studied with the idea of finding a condition which could predispose to the formation of gallstones, and yet could be paralleled in the male, because cholelithiasis is found in that sex.

The relation of pregnancy to gall bladder disease was first noted by Huchard in 1882. Since that time many writers have confirmed his observation. Osler stated that 90 per cent of women with gallstones have borne children, and Mayo<sup>2</sup> writes that "90 per cent of married women who have borne children have gallstones, and 90 per cent of these women identify the beginning of symptoms with some particular pregnancy."

In a recent series of 112 female patients with gall bladder disease, 95, or 84.8 per cent, had borne children. Of this group 20 patients definitely dated their first attack as occurring during or within the few months following pregnancy. Seven patients under thirty years of age were married, and in each case their attacks of gallstone colic preceded or followed their first delivery.

\*Read at a meeting of the Obstetrical Society of Philadelphia, October 6, 1927.

If, however, we inquire as to the incidence of gall bladder disease in a series of pregnancy cases, we are surprised to find the figures relatively low. In a group of 400 pregnancy cases recorded at the Maternity Clinic at the University Hospital, there were 16 cases who showed symptoms of definite gall bladder disease, an incidence of only 4 per cent. Six other patients had had gall bladder operations previously, all of which postdated pregnancies, making really an incidence of gall bladder disease of 5.5 per cent in 400 pregnancies. The average age of this group was 28.4 years.

For comparison, we subjected a questionnaire to 227 unmarried women, whose average age was 20.7 years. In this group we found:

- 1 gall bladder operation,
- 2 cases with pain in upper right quadrant,
- 4 cases with distention after meals, and
- 1 case with excessive gaseous eructations.

It is hard to evaluate this data, but it is doubtful whether more than 2 or 3 cases could be classed as cases of cholelithiasis.

The stones found in the young women whose gallstones were removed during or following a pregnancy, were small, round, soft, single or multiple, and composed almost entirely of crystalline cholesterol. The gall bladder in these cases was of normal color and texture and without adhesions.

Those removed from older women were larger, faceted, and pigmented, and were usually found in a gall bladder which was greyish-pink in color, thick, and often surrounded by dense adhesions.

These facts suggest the possibility that the stones are formed early in adult life, causing discomfort to the patient only by an occasional temporary obstruction of the cystic duct. As the patient grows older the stones increase in size and number, causing increasing trauma to the gall bladder wall, and inviting infection. By the time the patient reaches the late thirties, the gall bladder is a dense firm functionless organ, full of stones, causing constant disturbances of digestion with frequent attacks of sharp pain. She finally comes to the surgeon for relief of a disease which has really been of ten or fifteen years' duration.

Now let us turn to a study of gallstones themselves, and the relation pregnancy bears to their formation. The calculi have been divided by Mentzer<sup>3</sup> into two groups, according to their composition. The cholesterolin group, which comprises the large majority of gallstones, includes the pure cholesterolin stone; the radiate cholesterolin stone, radiating cholesterolin stones about a nucleus; and the common stone, mostly cholesterolin with varying amounts of bile pigments deposited as salts of various metals.

The other group is of calcium bilirubin stones, which contain very little cholesterin. They are small, black, spicular, multiple, and are found very rarely.

Because cholesterin forms such a large part of the majority of gallstones, Aschoff and Bacmeister<sup>4</sup> suggested some derangement of the body lipid metabolism as one of the chief causes of gallstone formation. They believed that an increase of cholesterol in the blood causes a commensurate increase in cholesterol excretion via the bile. Fasiani<sup>5</sup> has demonstrated experimentally that an increase in the cholesterol content of the bile follows intravenous injection of cholesterol. D'Amato<sup>6</sup> in feeding experiments found that foods rich in cholesterol increased the cholesterol of the bile from 6 to 8 mg. daily, and Stepp<sup>7</sup> fed rats and dogs on a lipid free diet for a number of weeks, and found the biliary cholesterol 10 to 15 per cent lower than the normal at necropsy.

An increase in biliary cholesterol combined with stasis and concentration in the gall bladder are factors, which, according to Aschoff<sup>8</sup> are sufficient to cause crystallization and precipitation of cholesterin. Stasis in the flow of bile is no doubt produced very frequently during pregnancy by the pressure of the distended uterus on the upper abdominal organs. To these factors has been added a fourth; viz., a change in the reaction of the bile toward the alkaline side, suggested by Lichwitz.<sup>9</sup> This may well be the part played by bacteria in the bile.

The primary factor, however, in the formation of most gallstones is probably a hypercholesterolemia, with a resultant increase in biliary cholesterol. The two commonest conditions in which the blood cholesterol may be increased over a long period of time are obesity and pregnancy.

Clinical and experimental evidence seems to support the view that blood lipoids parallel rather closely blood fats, so it is not hard to understand the formation of gallstones in patients covered with a thick layer of fat.

Pregnancy is the other common condition in which a long continued hypercholesterolemia occurs. The increase begins as early as the second or third month and continues until after delivery (Fig. 1).

The finding of the increased cholesterol in the blood has brought forth many interesting theories as to its cause. Fluhmann<sup>10</sup> has recently reviewed the subject in a most thorough manner. He presents the main theories as follows:

1. Those dealing with the excretion of bile. Some observers<sup>11</sup> by analysis of bile obtained by duodenal tube, have found a decrease in biliary cholesterol as pregnancy progressed. This they attributed to a damming back of cholesterol in the blood by the liver cells, and so accounted for the hypercholesterolemia.

McNee,<sup>17</sup> however, studied the bile directly in three patients who died in the later months of pregnancy and found markedly increased amounts of cholesterol.

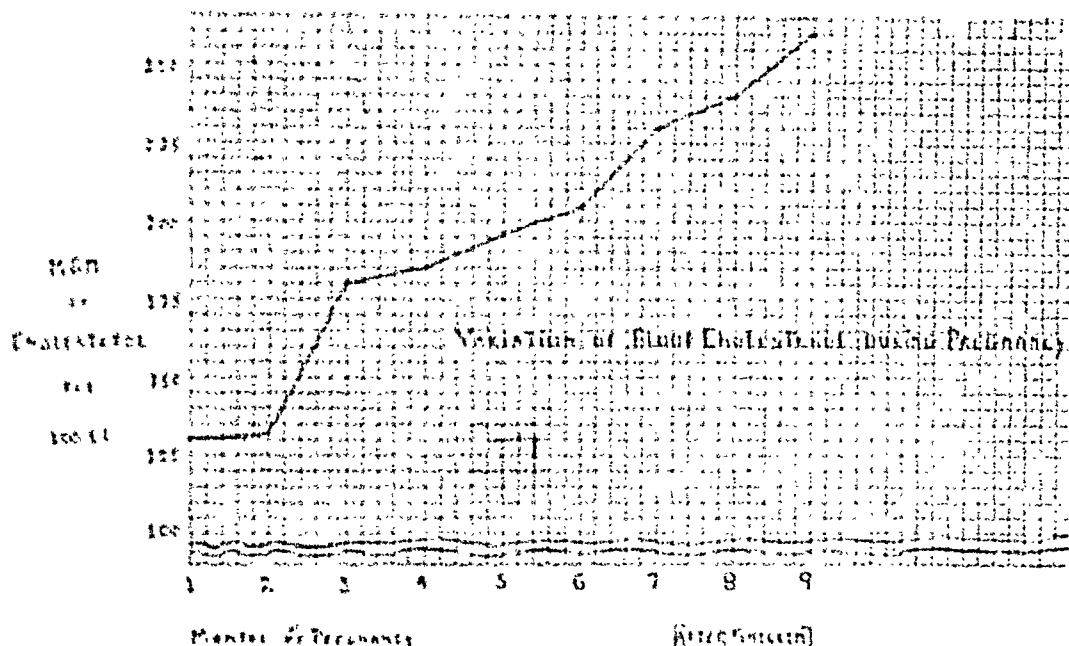


FIG. 1.

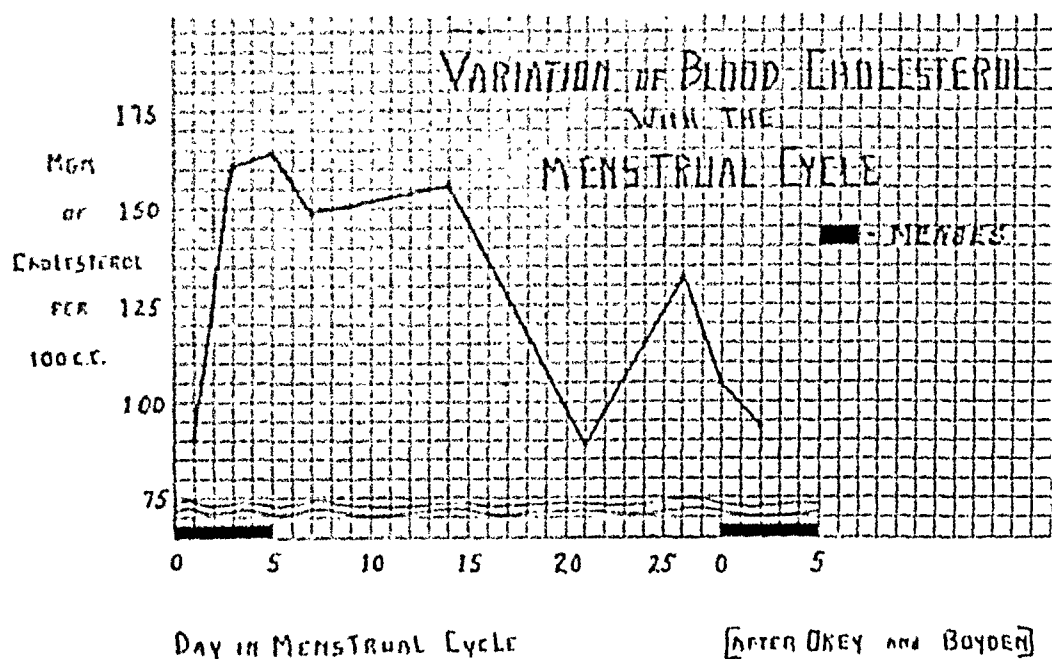


FIG. 2.

2. Those dealing with the glands of internal secretion. The ovaries are believed by Neuman and Herman<sup>18</sup> to undergo a functional alteration during pregnancy "which leads to an excessive formation of cholesterol." An alteration of blood cholesterol with the onset of

menstruation has been noted by Shiskin,<sup>14</sup> and more recently by Okey and Boyden<sup>15</sup> (Fig. 2).

The thyroid and especially the adrenal have been looked upon as the cause of the increased blood cholesterol, because of changes in these glands associated with pregnancy.

3. Those dealing with the toxemias of pregnancy. Several cases of high blood cholesterol during eclampsia have been reported, but Slemmons and Curtis<sup>16</sup> have shown that many cases of normal pregnancy have cholesterol values still higher.

4. Those dealing with lactation. Many writers look upon the increased blood cholesterol as a preparation for lactation. (Slemmons and Stander.<sup>17</sup>) They believe that the milk fats are synthesized from blood fats and lipoids, and Neuman and Herman<sup>13</sup> point out that the

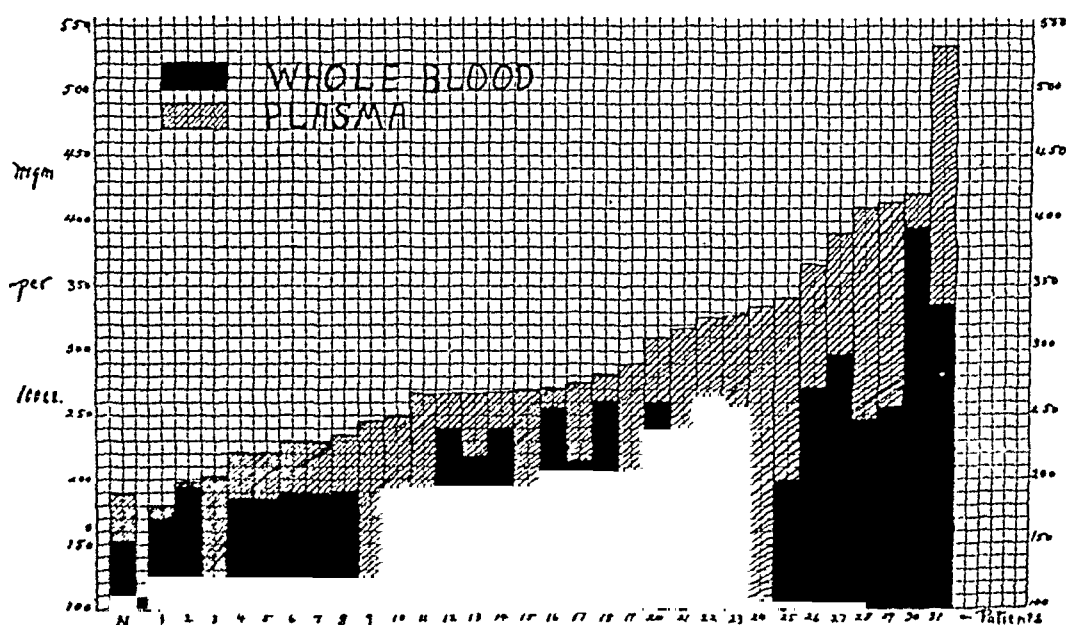


Fig. 3.—Blood cholesterol in women at term. "N" = normal values.

lipidemia persisted for a longer time after delivery in those women who did not nurse their babies.

5. Those dealing with fetal metabolism. The question of the relationship of the fetus to the hypercholesterolemia of the mother has not been settled. It seems, however, that the fetus has little to do with this constant change in the blood of the mother.

Whatever the cause of the increase in blood cholesterol, the fact remains that the increase exists. A study of this hypercholesterolemia was made on 34 pregnant women with the idea in mind of gaining some knowledge that might be useful in the prophylactic treatment of gallstones.

*Method.*—Blood was collected from the patients at term; on the second, seventh and twelfth days after delivery; and at monthly intervals after delivery. In most cases the collection was made after a period of starvation, but in a few

cases, as when a patient was admitted in early labor, the collection was made without regard to starvation. The cholesterol determinations were made at once by the Over-Knir modification of the Myers-Wardell method, on both the whole blood and plasma.

By this method Over and Knir report normal cholesterol range from 140 to 170 mg. per 100 c.c. of whole blood, with an average from 21 cases of 153.7 mg. The blood plasma in their cases was found to contain an average of 68 per cent of the cholesterol in the whole blood, and their plasma values ranged from one to one and a half times as high. The average value for 21 cases was 186.8 mg. per 100 c.c. of plasma. Fig. 3 shows the cholesterol values for whole blood and plasma of 31 patients at term as compared with the average normal values.

#### COMMENT

Table I and Fig. 3 show the high blood cholesterol values found in nearly every case. Age or previous pregnancy seems to have no constant effect on the amount of cholesterol present.

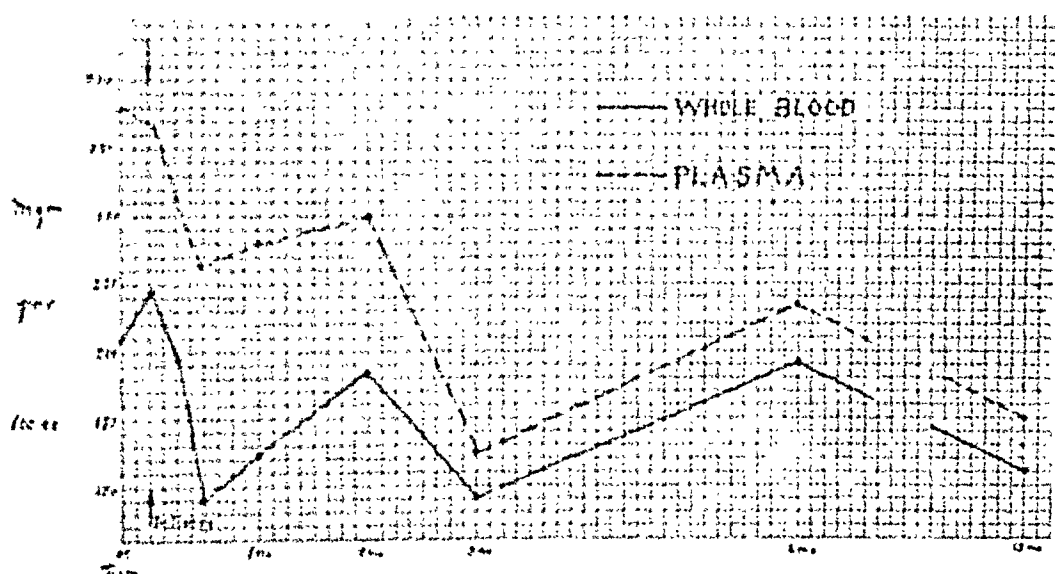


FIG. 4.—Blood cholesterol at term and after delivery. Base line represents months after delivery.

The high values found in cases of twin pregnancy may have some significance, but some of the cases of single pregnancy approached or surpassed the lower figures.

The cholesterol value does not fall immediately after delivery to the normal level, but remains high for some time. In several there was temporary increase after delivery (Fig. 4).

We have been able to follow eleven of these patients for a year and a half after delivery. Of these, eight patients (numbers 4, 6, 11, 16, 19, 20, and 27) have no symptoms. Three (numbers 8, 14, and 26) have had upper right abdominal pain and distention and belching after eating. None have had typical acute attacks of gallstone colic.

#### CONCLUSIONS

Since gall bladder disease occurs so frequently in females, and since the occurrence of the disease seems to bear a definite relation-



TABLE I. BLOOD CHOLESTEROL AT TERM AND AFTER DELIVERY

NO.	AGE	PARA	AT TERM	WHOLE BLOOD								PLASMA							
				2 DA.	7 DA.	12 DA.	1 MO.	2 MO.	3 MO.	6 MO.	1 YR. +	2 DA.	7 DA.	12 DA.	1 MO.	2 MO.	3 MO.	6 MO.	1 YR. +
3	18	0	187	220	195	212	160	170		203	163	240	183	234	140	163		215	163
6	20	0	189	180		202						185	205	220					
25	19	0	240	131								175							
30	18	0	256									472							
7	23	1	213	150	195	170	150	193		195		170	240	165	162			142	175
8	24	1	205	224	198	140	158		140	195	150	280	256	230	240	250	150	216	
13	28	1	240	207		240						334	328	320					
17	19	1	195		190	215					166	196	210	350					190
26	40	1	100	259	350							233	390						
23	19	1	110	50	246							242	260						
28	26	1	245									410							
32	21	1	219									265							
1	35	2	255	215	230							327	240	280					
22	23	2	170	100	247	185						180	300	220					
14	42	2	192		190	270			200		140	268	264	320			131		138
15	32	2	192		175	270						247							
20	21	2	185	220	235	153					162†	220	284	164					145
21	29	2	122	171	176	207						200	255	260					
2	34	3	255	215	230							327	240						
12	29	3	396	286	268	320						420	346	360					
18	35	3	255	260	200							270	340						
27	34	3	190		340	245					175	233	360	254					206
16	31	5	260		185	173	160			190	175	310	190	250	190			270	176
31	30	6	264									326							
34	40	6	199									340							
21	37	8	260	205	100	120	234				178	286	230	245	290				194
19	41	13	185	190	100						174	220	110						200
Twins																			
4	30	0	335	230	203	318					223	531	308	328					221
11	30	4	296	145	300	180					252*	390	240	210					332
33	24	2	240									316	318						

\*Nine months pregnant

†Three months pregnant

ship to pregnancy, it would seem that the prophylactic treatment would fall largely in the hands of the obstetrician.

Calculi, which are probably the chief cause of the symptoms and pathology in this disease, are composed largely of cholesterol in most cases. The cholesterol is obtained from that excreted in the bile and biliary cholesterol varies with the cholesterol in the blood. During pregnancy there is a definite hypercholesterolemia, which in all probability predisposes to the formation of gallstones, and may be the reason for the relationship between gall bladder disease and pregnancy. Prophylactic treatment may well be directed toward keeping the blood cholesterol at the lowest possible level at this time. The cholesterol of the blood is dependent in a large measure upon the diet, hence one method of accomplishing this purpose would be to reduce the ingestion of cholesterol-bearing foods. Such foods as fat, egg yolk, fried foods, sweetbreads, liver, kidney, pork, oily fish, butter and cheese might well be omitted from the diet, or used in extreme moderation.

The early diagnosis and surgical treatment of those cases of cholelithiasis which show symptoms during or following a pregnancy will prevent the progress of the disease, give to the surgeon a patient who is a good operative risk, and often allow the preservation of a normal gall bladder.

We wish to express our thanks to Dr. J. C. Hirst, II, of the Maternity Department of the University Hospital and to Dr. W. G. Karr, of the Laboratory of Biochemistry of the Philadelphia General Hospital, for their interest and help in the preparation of this paper.

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## THE ETIOLOGIC SIGNIFICANCE OF LOWERED BLOOD-SUGAR VALUES IN VOMITING OF PREGNANCY\*

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THE theory that a deficiency in carbohydrate reserves is responsible for the development of nausea and vomiting during pregnancy has a well-defined physiologic basis. This does not need to be repeated here, however, because it has become familiar from having been outlined several times previously. That it is not merely an unsubstantiated theory is demonstrated by the fact that high carbohydrate feedings and intravenous injections of glucose (dextrose) have proved so promptly and consistently beneficial in the relief of hyperemesis.

The findings recently published in a preliminary report by our group<sup>1</sup> which show that eclampsia is characterized by wide fluctuations in blood-sugar values and that the convulsions follow periods of what we have termed "relative hypoglycemia," have advanced definite evidence of what has long been reasonably assumed, namely, a relationship between a disturbance in carbohydrate metabolism and eclampsia.

We wish now to present evidence which we believe establishes a similar relationship between hyperemesis gravidarum and a metabolic deficiency in carbohydrates. If acceded this would likewise argue a basic etiologic relationship between the various toxic manifestations of both early and late pregnancy.

### BLOOD-SUGAR STUDIES IN HYPEREMESIS

The evidence on which we base this present work is taken from a study of the initial blood-sugar values in patients entering our service with hyperemesis gravidarum (Folin-Wu technic).

For some time past the rule has been established in our clinic that a blood-sugar reading must be made on each such patient admitted before our usual active treatment may be instituted. Excepting in a few instances this specimen was taken at eight o'clock or shortly after on the morning following the patient's admission, for reasons that will be described.

In order to make conditions under which the initial blood sugar was determined in each of these cases as nearly alike as possible, namely a period of over-night fast followed by a morning reading, we have arranged certain routine procedures.

\*This study is one of a series of investigations in the subject of pregnancy toxemia being conducted under the generous provisions of the John C. Oliver Memorial Research Foundation recently established at the Laboratory of St. Margaret Memorial Hospital, Pittsburgh.

The first step in our routine general care of such patients is to establish a period of complete fast so far as the administration of food, drink, or medicine by mouth is concerned. This is continued for four to six hours, after which it is arranged to have a period of about eight hours during which the patient is given by mouth nothing more than one-half to one ounce of water every fifteen minutes even awakening her for this if necessary.

So far as possible we have arranged to have these patients admitted to the hospital in the late afternoon or early evening so that the first period could continue until midnight, the second from midnight to eight in the morning, after which the dietetic treatment of the "second twenty-four hours" could begin.

Formerly we administered glucose quite promptly by vein or by bowel, according to the seriousness of the patient's condition. Latterly, however, we have refrained from doing this until these studies could be completed, excepting of course in those few instances where the patient was in desperate condition and required immediate intravenous injection of glucose. During this preliminary fasting period the proctoclysis begun soon after admission as a routine measure is merely tap water instead of glucose as formerly.

Our chief reason, in fact, for presenting such a small series of cases as that of this present report, is that we wish to return to our previous plan of prompt administration of glucose as required and indicated rather than to have this delay which has been necessary to our studies.

Probably it would have been equally suitable to take a specimen immediately on admission because patients with hyperemesis of a degree sufficient to warrant their entering the hospital for treatment are virtually fasting when admitted. However, some of them shortly before admission might have taken and retained enough nourishment to alter their blood sugar from that of a fasting value so it was decided thus to eliminate this occasional source of error. Those patients who were so seriously ill as to require active treatment were obviously in a fasting state, and their specimens were taken at once so that the urgently needed glucose injections could be begun immediately.

It may be stated, therefore, that the blood-sugar values in this series of hyperemesis cases were determined under similar circumstances and standard conditions.

#### ANALYSIS OF SERIES

Forty cases were studied as has been described. In grouping them according to the severity of the condition, we have adhered to the original classification of Titus which was similar to but somewhat more rigid in its first group than that of Harding, namely, "Mild" or Group I, "Moderately severe" or Group II, and "Severe" or Group III. Among these cases under consideration there are none that even border on Group I since it is obvious that a woman who is only mildly ill with

nausea and vomiting will not be sent to the hospital for treatment. Group I patients are treated at home by dietetic instructions.

Of the forty patients thirty-two fall into Group II and eight into Group III.

TABLE I. INITIAL BLOOD-SUGAR VALUES IN HYPEREMESIS CASES (40)

BLOOD SUGAR MG. 100 C.C.	BELOW 80	80 TO 100 INCL.	ABOVE 100	TOTAL
Group II	18	11	3	32
Group III	7	1	0	8
All cases	25	12	3	40

It will be seen from Table I that by far the greater number show blood-sugar values below normal or average if 80 to 100 mg. is to be considered as an average nondiabetic value.

No attempt has been made to establish percentage values because of the small group of cases being presented, but the preponderance of numbers below average values is striking. In fact only one of the cases in Group III is above eighty, this patient showing 94 mg. per 100 c.c. of blood.

TABLE II. ANALYSIS OF CASES (12) SHOWING NORMAL VALUES  
(80 to 100 mg. sugar per 100 c.c. blood)

80-84	85-89	90-94	95-100	TOTAL
8	2	1	1	12

Even in the cases showing normal or average levels of blood sugar, the tendency as seen in Table II is toward the lower rather than the upper limits of average range.

TABLE III. ANALYSIS OF CASES (25) SHOWING VALUES BELOW 80 MG.

BLOOD SUGAR MG. 100 C.C.	20-29	30-39	40-49	50-59	60-69	70-79	TOTAL
Group II	0	0	1	1	7	10	18
Group III	1	0	1	1	1	3	7

Further elaboration of Table III should be made by stating that the six lowest readings obtained were as follows: 28 mg. (Group III); 42 mg. (Group III); 42.1 mg. (Group II); 53 mg. (Group III); 53 mg. (Group II); and 64 mg. (Group III). It is thus apparent that the lowest values were seen most often in the sickest patients.

That one patient, even though extremely ill could show such a low reading as 28 mg. without hypoglycemic convulsions might at first seem to be unlikely and to indicate some error even though the reading was carefully checked, until an opinion of Macleod<sup>2</sup> is recalled. He states in effect that the level at which hypoglycemic symptoms follow insulin administration may depend not so much on any absolute level of blood sugar as it does on the rapidity with which that level is reached.

This opinion was quoted in connection with our eclamptic blood-sugar studies to explain our term "relative hypoglycemia." We had said that eclamptic convulsions were usually preceded by sudden drops in blood sugar to levels which could be classed as relative hypoglycemia, and that these levels might hover around average or normal values as we ordinarily think of them, or even be much higher, and still be "relatively hypoglycemic" if a few moments before they had been, as we demonstrated, 50 to 80 mg. or more above that value.

The point we emphasized was that the convulsions were produced by the suddenness of this drop in blood sugar which frequently took place in no more than a few minutes' time, and that the actual level of the blood-sugar value has little or nothing to do with the phenomenon known as a hypoglycemic convulsion.

Not until after our preliminary report regarding this did we know of a paper by Johns in which he discussed hypoglycemic reactions following insulin administration occurring in a group of twenty-four diabetics. In only thirteen of these was the blood sugar at a level of 80 mg. or less, while in the remaining eleven it was above 80 mg. In five of these patients typical toxic symptoms occurred with the extraordinary blood-sugar values of 200 mg. or over. These patients undoubtedly conform to the condition which we have designated as "relative hypoglycemia" since it is obvious that their blood-sugar levels had been much higher a few moments before, and had been suddenly reduced to these other levels, still high, but relatively hypoglycemic, by the insulin which produced the reaction.

To return to the hyperemesis cases, it is equally possible for a glycogen depletion to go on in such a case even to this low level of 28 mg. without producing the familiar hypoglycemic symptoms (twitching and convulsions) because this has been such a slow process. Days and weeks have been consumed in bringing the patient to her present state, and in the meantime her nervousness and tremor are the only hypoglycemic symptoms. It is not unreasonable to think that the neurotic symptoms shown so frequently in hyperemesis may be a result of its accompanying hypoglycemia, rather than a cause of the vomiting as has been so commonly assumed.

This same degree of glycogen depletion (to a blood sugar of 28 mg.) would inevitably have caused convulsions had the process been more fulminating in its progress, as it always is in eclampsia or following insulin overdosage.

#### RELATIONSHIP BETWEEN VARIOUS TOXICOSES OF PREGNANCY

It is probable that herein lies one of the chief differences between the clinical manifestations of hyperemesis gravidarum and preeclampsia or eclampsia. Granting the basic underlying cause of pregnancy toxicoses to be that which we are advancing, namely, disturbance in carbohydrate metabolism on the side of a carbohydrate deficiency resulting chiefly from fetal demands, there are many influencing factors which

serve to make the clinical symptoms of toxemia of early pregnancy vary greatly from those of late pregnancy.

In early pregnancy the carbohydrate deficiency results from a combination of low carbohydrate intake on the part of the mother plus the extra burden of fetal requirements to which she was unaccustomed, this latter initiating the trouble. This opinion is constantly affirmed by inquiry into the dietetic habits and preferences of patients with hyperemesis. Almost invariably they report a preference for protein foods and an indifference or even dislike for carbohydrates, especially sweets. If this dislike does not exist the patient will usually admit having stood prolonged guard over her diet in order to reduce her weight or to remain thin.

In late pregnancy the fetal needs are even greater, and while the patient's food intake may be fairly normal for her it is likely to be poorly balanced with proteins predominating. An attack of eclampsia is usually initiated by the patient gorging on protein foods or indulging in some other dietetic indiscretion. This is therefore an acute condition, whereas the progress of hyperemesis from bad to worse is usually more gradual. Dehydration is another factor altering the picture, present in hyperemesis but absent in eclampsia.

Convulsions are the spectacular feature of toxemia of late pregnancy while vomiting is the outstanding characteristic of early pregnancy toxemia. Even though these two states are usually so different clinically an etiologic relationship is nevertheless shown by the fact that fulminating cases of hyperemesis which are called "acute yellow atrophy of the liver" will show, since here the progression is swift enough, typical "eclamptic" convulsions even though the patient may be no more than eight or ten weeks pregnant. Moreover the nephritis seen so constantly in eclampsia is imitated in severe grades of hyperemesis.

#### GENERAL

An attempt was made to recall these patients for blood-sugar readings six months to a year after their subsequent confinement, but only seven responded. No conclusions could be attempted, therefore.

It is interesting that the patient who showed the highest initial blood sugar of our hyperemesis series (175 mg. per 100 c.c. Group II) had a normal value of 100 mg. three months after her baby was born (she was not lactating at this time). Before her entry to the Hospital she had made an unsuccessful attempt to control her nausea and vomiting by following directions for a high carbohydrate diet at home. It is possible that this affected her initial level. She was quickly and permanently relieved in the hospital being discharged on the eighth day after admission.

For the purposes of this particular study further blood-sugar readings after an injection of glucose, or after its administration by bowel

or by mouth, are fruitless, so that in this report only these initial figures are being presented.

Half-hourly or hourly readings following an intravenous injection of glucose with the plotting of a glycemia curve as described by our group in 1922<sup>1</sup> are of importance, but not in this connection so will not be discussed here.

#### NECESSITY FOR LABORATORY CONTROL OF TREATMENT

That careful laboratory control of these patients is essential is illustrated by the case of a patient ten weeks pregnant sent to the hospital on the natural supposition that she presented an uncomplicated case of advanced hyperemesis of pregnancy. She was emaciated and dehydrated, vomiting almost continuously, slightly jaundiced and in a muttering delirium with a heavy odor of acetone on her breath. Physical examination showed nothing more than a gingivitis, the emaciation mentioned, and the existence of an early pregnancy.

It was assumed without question that this was an ordinary case of hyperemesis gravidarum, but before giving her the first intravenous injection of glucose solution a specimen of blood was taken for blood sugar and her urine was examined.

Her blood sugar was found to be 230 mg. per 100 c.c., and the urine not only contained albumin, acetone and diacetic acid, and casts, but also gave a heavy reaction for the presence of sugar.

This was an unsuspected case of diabetic coma. But for the laboratory control the patient would have had an intravenous injection of glucose solution after which she might naturally have been classed as a severe and eventually fatal case of uncontrollable vomiting of pregnancy.

Details of treatment have been outlined elsewhere and have no place in this discussion except in respect to two points emphasized by these findings.

The lowered blood-sugar values in these cases indicate a depletion of glycogen reserves, and the reason for the benefit obtained in such cases from intravenous injections of hypertonic glucose solution is immediately apparent. As was stated in connection with our eclampsia studies the administration of insulin without glucose for any disease with a hypoglycemic basis is obviously dangerous. Moreover, to give it with the glucose is unnecessary because of the ability of this patient's pancreas to manufacture its own insulin in direct response to the sugar injection.

All of the patients reported recovered promptly under the influence of appropriate treatment, and no therapeutic abortions were necessary in this series. One patient aborted spontaneously while still in the hospital.



## SUMMARY

1. The carbohydrate deficiency theory as the chief underlying factor in the causation of pregnancy toxemias has been physiologically reasonable; the success of the therapeutic measures founded on this theory has been convincing, but laboratory proof of its correctness has been lacking.

2. Recent work on the fluctuations in blood sugar during eclampsia has demonstrated that a disturbance in carbohydrate metabolism is a factor in this toxicosis of pregnancy, and that eclamptic convulsions are hypoglycemic reactions occurring at the low point of these fluctuations.

3. Blood-sugar readings taken under certain standard circumstances from patients with hyperemesis gravidarum indicate that in this condition low values predominate as a characteristic of this diseased state.

4. Even among those patients showing normal values (80 to 100 mg.) the tendency is toward the lower rather than the upper limits of the average range.

5. Such tendencies indicate a glycogen depletion in hyperemesis, previously postulated from clinical observation.

6. The lowest values indicative of the most profound glycogen depletion of the tissues are to be seen in the sickest patients.

7. Hypoglycemic levels may be attained in hyperemesis which if compared to similar values obtained more rapidly from insulin overdosage would be expected to cause convulsions, but which fail to do so because this process of glycogen depletion is a slow one. Fulminating cases of hyperemesis, or "acute yellow atrophy of the liver" frequently show convulsions early in pregnancy which are comparable to those of eclampsia, late in pregnancy.

8. The probability of an etiologic relationship between toxicoses of early and of late pregnancy is strengthened by these observations and findings.

9. The reason for the successful results from the hitherto empiric treatment of hyperemesis by intravenous injections of glucose and other administration of carbohydrates is now apparent.

10. The use of insulin without glucose in hyperemesis is shown by these low sugar values to be a dangerous procedure. Its use with glucose has already been questioned.

11. Careful laboratory control of the blood chemistry of these patients with particular respect to their blood-sugar values, is essential to their treatment.

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# OBSERVATIONS ON THE BIOCHEMICAL CHANGES IN THE BLOOD FOLLOWING RADIUM THERAPY\*

## A REPORT OF 100 IRRADIATED CASES

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### INTRODUCTION

MANY patients following exposure to radium show severe symptoms of radium sickness, manifested by nausea and vomiting. Others show very little or no discomfort. Inasmuch as a certain number of irradiated patients show a reaction which is not accounted for on a definite basis, chemical observations were made on the blood and urine of 100 patients who were treated with radium on the gynecologic service at the Long Island College Hospital with the hope of establishing some hitherto unknown relationship between the reaction and chemical changes in the blood.

The reactions following irradiation with radium or x-ray have been explained in various ways. The more important of these theories may be tabulated under the following headings: (1) intoxication; (2) acidosis; (3) metabolism; (4) inhalation; (5) enzyme; and (6) nephritic. These we may well review at this point.

1. *Intoxication*.—Edsall and Pemberton advanced the belief that roentgen rays produced a constitutional reaction, which they ascribe to an acute intoxication. Their explanation being that the roentgen rays destroyed tissue which was rich in nucleoprotein. The decomposition products of this form of protein were more or less toxic and difficult to excrete. They also added that the intoxication was independent of any alteration of excreting power of the kidneys. Linsler and Sick, Engel and others, have claimed that the roentgen rays produced a roentgen toxin in the blood which might be responsible for the protein destruction.

2. *Acidosis*.—Lange believed that the reaction was a result of an acidosis which he based on cellular degeneration, an increased catabolism. Because of this belief, he employed sodium bicarbonate in large doses to overcome the constitutional effects. The work of Denis, Alrich and Martin supported this idea, for they observed an acidosis in rabbits when some portion of the intestinal canal was included within the irradiated area. Hirsh and Peterson found a disturbance of the acid-base equilibrium as manifested immediately after treatment by an increased hydrogen-ion concentration and sometimes by a slight lowering of alkali reserve. In the blood, however, these relationships were reversed twenty-four hours later. There was diminished hydrogen-ion concentration and an increased alkali reserve.

These latter results are in accordance with those obtained by Hussey in rabbits. The latter observer believed the mechanism of increased alkalinity of the blood to

\*Read before the New York Obstetrical Society, December 13, 1927.

be the result of a transient acidosis produced. Golden from observations on patients treated and on dogs exposed experimentally to roentgen ray found no diminution of alkali reserve.

3. *Metabolism*.—As regards metabolism studies of persons treated with roentgen rays or radium, numerous contributions have been made on the study of leucemic patients. The work of Keymling and Murphy, Means and Aub stands out. They observed that patients suffering from leucemia showed an increase in basal metabolism and usually a negative nitrogen balance. The uric acid of the blood was usually about normal and the endogenous uric acid elimination was usually increased. Goodall believed that the roentgen-ray therapy might not have a definite effect on leucemia, but it usually caused an increased elimination of nitrogen, uric acid, and purin bases. The fall in the leucocyte count did not bear any constant relationship to the elimination of nitrogenous substance. Quadroni working with rabbits and guinea pigs found a slight increase in phosphoric acid output following radiation. Block studied the metabolism of one case radiated for chronic eczema. He found an increase in the output of uric acid, phosphoric acid, and purin bodies. Benjamin and Reuss radiated one dog and they found an increase in nitrogen elimination beginning immediately and lasting several days. They found only a transient increase in the phosphoric acid. This was confirmed by Lommel who conducted similar experiments on young dogs. Linser and Sick studied five patients who were being treated—radiated for skin diseases. They showed no radiation sickness but their output showed an increase in urinary nitrogen of two or three grams, while their uric acid output was even tripled in some cases.

Hall and Whipple found an increase in total nonprotein nitrogen and urea nitrogen in the blood of dogs exposed to roentgen rays which usually increased much above normal shortly before death. The elimination of urine nitrogen was increased on the day following treatment and remained high until death. They further observed focal areas of necrosis in the lining of the small bowel, which they believed might be responsible for the general intoxication with its vomiting and diarrhea, etc.

Hirsh and Peterson after making a chemical study of the blood of patients treated with roentgen rays concluded that there was no striking or consistent alterations in the urea nitrogen, nonprotein nitrogen, uric acid, or sugar concentration of the blood after treatment. Schmitz showed that carcinoma patients with severe reaction following roentgen-ray and radium radiation had an increase in the blood nonprotein nitrogen. He believes that "radiation sickness" is caused by the absorption of autolytic products from the degenerative areas of the tumor mass and considers the reaction to be nonspecific.

4. *Inhalation*.—Pfahler, and later Wilbert, advanced the theory that the constitutional symptoms were the result of inhalation of certain gases (ozone) produced in the air by the action of the high tension current.

5. *Enzyme*.—Heile believed that the destruction of white blood cells resulted in the release of a great store of intracellular enzymes which then attacked various tissue to produce the protein destruction noted. Baerman and Linser, Rosenstein, Edsall have suggested that roentgen rays might have stimulating action on enzyme activity in general and particularly in those cases on enzymes which produce tissue autolysis. There are observations which indicate that body ferments in the living tissues are actually influenced by the roentgen rays. Heile observed that a spleen removed from a radiated animal showed more rapid autolysis than the control. Hall and Whipple showed that the same phenomena occurred when intestinal mucous membrane was exposed to roentgen rays. Richards, in his extensive work on the effect of roentgen rays on ferments, demonstrated that a short radiation accelerated

enzyme activity, while a longer radiation inhibited it. This point is disputed by Richter and Gerhardt who maintain that roentgen rays have absolutely no effect on ferments. Wohlgenuth working with the effect of radium emanations on enzyme activity showed that radium rays stimulated the autolysis of tuberculous tissue in vitro. Newberg demonstrated that fresh carcinoma tissue autolysis more rapidly in vitro under the influence of the radium emanations than does a control not so exposed.

6. *Nephritis*.—Some workers have attempted to explain the constitutional effects following roentgen-ray radiation on the basis of a production of a nephritis. Schleip and Hildebrand, Von Jaksch, Heyman, Probaum and Rotsky, Linser and Heller, Rosenstern, Warthin and others, belong to this school. Negative findings as to the production of a nephritis following radiation have been reported by Hurdle and Schmidt, Krause and Ziegler, Hull and Whipple and their associates, and many others. McQuarrie and Whipple from the studies on dogs exposed to roentgen rays were forced to conclude that the kidney epithelium was much more resistant to x-ray injury than was the epithelium of small intestine; further that moderate doses of roentgen rays given repeatedly over considerable periods of time had no demonstrable influence on renal function or structure.

Routinely, all gynecologic patients enter the Long Island College Hospital at least forty-eight hours prior to operation. During this period a careful study of the patient is made. This includes a complete history and physical examination, blood pressure, urine, kidney function, examination of the blood, sedimentation time, and any other diagnostic procedures which may add to complete work-up of the case. Besides this routine on the 100 cases which contribute the data for this paper, a pre- and postoperative blood chemistry was done on all cases where radium was to be used. The blood was drawn from the median basilic vein of the arm before breakfast on the morning preceding radiation. The diet of these patients prior to radiation was the usual hospital soft diet, chiefly carbohydrates. During the treatment and postradium period, food was allowed as tolerated, starting with fluids and selected soft diet. Immediately upon the removal of the radium or within six hours after its removal, another blood specimen was taken. The urea, urea nitrogen, uric acid, creatinine and sugar of the blood thus obtained were determined according to the method of Folin and Wu. The  $\text{CO}_2$  combining power of the blood plasma was determined according to the method of Van Slyke. A routine Wassermann examination was done in these cases. A postoperative radiation urine analysis was also included. From the time of insertion of the radium and for two or three days after its removal, these patients were carefully watched for the appearance of any unusual symptom and particularly for the so-called "radium sickness" (nausea and vomiting).

In Tables I to IX, we have attempted to give our results without any attempt at description, except the captions appearing below each table, thus eliminating unnecessary repetition and a saving of much valuable time for the reader.

TABLE I. GENERAL CLASSIFICATION OF THE CASES FOR STUDY. BENIGN 62 CASES, MALIGNANT 37 CASES, AND UNCLASSIFIED 1 CASE




BENIGN		62 CASES
MALIGNANT		37 CASES
UNCLASSIFIED		1 CASE

TABLE II. SHOWS A GROUPING OF THE CASES ACCORDING TO DIAGNOSIS, CARCINOMA OF CERVIX, FIBROID UTERUS, AND ENDOMETRIAL HYPERPLASIA COMPRISE THE LARGER GROUPS

DIAGNOSIS	NO. OF CASES
CARCINOMA OF PERINEUM	1
CARCINOMA OF CERVIX	22
RECURRENT CA OF CERVIX	5
ADENOCARCINOMA OF UTERUS	8
CARCINOMA OF RECTUM	1
URETHRAL CARUNCLE	2
CERVICAL POLYP	4
FIBROID UTERUS	16
ENDOMETRIAL HYPERPLASIA	16
HYPERPLASTIC ENDOMETRITIS	14
POLYPOID ENDOMETRITIS	7
SUBACUTE INFEM. ENDOMETRITIS	3
SPERMATOCYSTIC LEUKEMIA	1

TABLE III. AMOUNT OF RADIATION USED: 1200, 1800, 2000, AND 3000 MG. HR. DOSAGE PREDOMINATE

RADIATION	NO. OF CASES
200 MHRS.	1
250 "	2
400 "	4
500 "	4
600 "	3
750 "	1
800 "	4
1000 "	3
1200 "	20
1350 "	2
1500 "	8
1600 "	1
1700 "	10
1800 "	10
2000 "	2
2150 "	4
2400 "	5
2500 "	4
3000 "	12

TABLE IV. NUMBER OF CASES SHOWING RADIUM SICKNESS (NAUSEA AND VOMITING)

REACTION	41 CASES
AD REACTION SYMPTOMS	58 CASES

TABLE V. RELATION BETWEEN INCREASED BLOOD UREA AND REACTION

REACTION SYMPTOMS	58 CASES	75% OR MORE IN BLOOD
AD REACTION SYMPTOMS	62 CASES	62% OR MORE IN BLOOD
AVERAGE AD CASES	70 CASES	70% OR MORE IN BLOOD

TABLE VI. SHOWS OCCURRENCE OF ALBUMINURIA IN THE 100 CASES, BEFORE IRRADIATION THERE WERE 11 CASES THAT HAD AN ALBUMINURIA OF SOME DEGREE, WHEREAS AFTER IRRADIATION THERE WERE 12 CASES, SHOWING AN INCREASE OF ONLY 1 CASE AS A RESULT OF IRRADIATION OF ANESTHESIA OR PERHAPS BOTH

PRE-RADIATION	11 CASES
POST-RADIATION	12 CASES

TABLE VII. GENERAL CLASSIFICATION OF CASES USED WITH RELATION TO REACTION AND RISE IN BLOOD UREA

	NO. OF CASES	REACTION	INCREASE IN BLOOD UREA QUANTITY
Benign	62	30	60
Malignant	37	10	35
Unclassified	1	1	1
Total	100	41	96

TABLE VIII. TIME AND TYPE OF ANESTHESIA EMPLOYED AND THEIR RELATIONSHIP TO THE RISE IN BLOOD UREA

TYPE OF ANESTHESIA	NO. OF CASES	TIME OF OPERATION	INCREASE IN BLOOD UREA QUANTITY
Nitrous Oxide	16	27 min.	16
Nitrous Oxide and Ether	81	30 min.	78
Ether	1	22 min.	1
Chloroform	1	20 min.	1
No Anesthesia	1	---	---
Total	100		96

TABLE IX. COMPARISON OF THE AVERAGE PRERADIUM AND POSTADIUM BLOOD UREA, UREA NITROGEN, URIC ACID, CREATININE, AND THE VARIATION. FOLLOWING TREATMENT THERE WAS AN AVERAGE INCREASE OF THE BLOOD UREA 20 PER CENT, UREA NITROGEN 20 PER CENT, URIC ACID 14 PER CENT, CREATININE 13.3 PER CENT, AND ALKALI RESERVE (CO<sub>2</sub>) 11.6 PER CENT

	UREA	UREA N.	URIC ACID	CREATININE	ALKALI R. (CO <sub>2</sub> )
Before treatment	33.7	15.80	2.65	1.15	43
After treatment	40.7	19.04	3.02	1.70	48
Variation	7.0	3.22	0.37	0.20	5
Percentage increase after radium	20%	20%	14%	13.3%	11.6%

From this study we believe the following deductions may be formulated:

1. Forty-one per cent of our cases showed a mild reaction which might have been due in part to the preoperative atropine and morphine and the anesthetic.

2. Blood urea was elevated slightly in both benign and malignant conditions following radium irradiation.

3. No definite relationship could be established between the increase in the blood urea and the reaction.

4. The CO<sub>2</sub> combining power of the blood was not affected by irradiation.

5. The chemical and laboratory findings did not indicate any evidence of renal impairment following irradiation.

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# INTRAABDOMINAL HEMORRHAGE FROM RUPTURE OF A UTERINE VEIN DURING PREGNANCY

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**H**EMORRHAGE into the abdominal cavity is a rare but very serious accident of pregnancy. I wish to report one such case which recovered after an operation done under a mistaken diagnosis of separation of the normally implanted placenta. Study of the literature which is presented herewith shows that the diagnosis might be made more often if only the possibility were kept in mind.

The patient was a primipara, at thirty-one weeks pregnant, thirty-one years of age, admitted to the Hartford Hospital in labor on July 1, 1927. Her physician, Dr. A. H. Clark, was called to see her at 6 A.M. because of a sudden sharp lower abdominal pain. She had previously been under his care and pregnancy had progressed normally. There had been no deviations from normal in the blood pressure, water, or physical exam. Dr. Clark noted when he first saw her that she was having irregular contractions of the uterus and that the abdomen was unusually tender, almost rigid. Being very careful despite presentations he examined vaginally and found that the external os admitted one finger, the canal was partly obliterated and the membranes did not bulge. He brought her at once to the hospital, and I feel that it was due to his prompt action that we are able to report such a happy result.

I saw the patient in consultation at 11 A.M. and noted likewise that the abdomen was extremely tender and that ineffectual contractions of the uterus were present. The entire uterus appeared to be very sensitive and tense but it lacked something of the firmness consistency which one observes in cases of intrauterine concealed hemorrhage. Her general condition was good, pulse rate was 80 and of fair quality and she showed no pallor. Another very careful examination was made which confirmed previous findings, though I noted two small dark-colored blood clots. I thereupon made a diagnosis of premature separation of the normally implanted placenta with concealed hemorrhage and ordered the patient prepared for cesarean section. Operation was started at noon, by which time the patient's blood pressure was 90/50. Intravenous saline was given during the operation.

Under gas-oxygen-ether anesthesia a lower midline incision was made. On opening the abdomen a large amount of free unclotted blood was found, estimated at 600 to 800 c.c. A premature child of about 31 weeks' development was removed by classic cesarean section. The child died a few hours later. The placenta was removed without difficulty and showed no area of separation. Careful inspection of the uterine wall showed no trace of intramural hemorrhage and the uterine incision was closed in layers with No. 2 plain and chromic catgut. After removing the fluid blood two or three organized blood clots were removed from the pelvis and separated from loose omental attachments. These clots appeared to be much older and were considered to have originated about the time of a previous attack of pain which the patient later reported had occurred five days before her present illness. Both tubes and ovaries were normal. A brisk venous hemorrhage was observed coming from a dilated vein situated about 1 cm. from the right uterine horn behind it and toward the midline. This was easily controlled with a single catgut suture. No other source of hemorrhage could be seen and the abdomen was closed.

The patient's condition was better at the close of the operation than at the beginning, pulse rate 85, systolic blood pressure 100. She had been given 1/6 gr. of



morphine and one ampoule of pituitrin and one of ernutin just before the operation. The puerperium was moderately febrile for the first four days. Wound healing was excellent, and she was discharged from the hospital twenty-two days after the operation with a final diagnosis of intraabdominal hemorrhage from a uterine vein, 31 weeks' pregnancy, puerperal endometritis following cesarean section, secondary anemia. She was advised to have a cesarean section with any subsequent labor.

The first case which I found reported in the literature was that of Fritsch<sup>1</sup> in 1877. This patient was twenty-eight years of age, para iii. When he first saw her, pain was confined to the abdomen and uterine contractions were present but were not very marked. Because of an increase in respiration and pulse rate he examined the heart and lungs and found nothing abnormal. There was no fever, the cervix was two fingers dilated, buttocks presenting and a good prognosis was given, the patient being left in charge of a midwife. Twelve hours later he received word that she had died. "The midwife reported that she had gone on with weak pains, became more pale, failed rapidly and died." Autopsy was performed by Marchand who found a large amount of fluid and coagulated blood in the abdomen. On the left posterior part of the true pelvis where the peritoneum began to pass over the uterus there was a small opening. The sides of the uterus were covered with very large thin walled veins. A hole in the peritoneum was seen which measured 8 mm., the edges were reddened and rough and access was had immediately into a large vein. The hole in the vein itself measured 4 mm. Examination of the edges with a lens showed that they appeared to be eroded. Fritsch was inclined to believe that this was caused by pressure necrosis by some fetal part though he admitted he came to this conclusion for want of a better explanation.

In Fritsch's case the hemorrhage came from a varicose vein which did not lie in the uterine body itself but just outside. It would appear that signs of internal hemorrhage might have been detected in time to save the patient's life had she been under the observation of some one alert to this possibility.

Leopold<sup>2</sup> in 1901 reports a case of rupture of a parametrial vessel during labor with fatal outcome. This patient had a flat rickety pelvis, was at full term and had a difficult delivery by version and extraction after a contraction ring that developed. The child died a few minutes later, the uterus contracted well, there was no external bleeding and the placenta came away intact. Careful inspection of the birth canal showed no tears as far as could be seen into the cervix. One hour later the pulse was noted as small and the patient was quite restless. There was no external bleeding. Salt solution was given and there developed a soft tumor in the region of the right broad ligament leading to the suspicion that rupture of the uterus had occurred. Internal examination disclosed no point of rupture. However, in the presence of an undoubted rupture of some blood vessel in the broad ligament, the uterus was packed and pressure exerted against the broad ligament. The patient failed rapidly, however, and died three hours after delivery. Autopsy showed death due to anemia from hemorrhage of a uterine vein in the right broad ligament which had ruptured into the abdominal cavity. There was a tear 3 cm. long in the peritoneum of the right broad ligament but the musculature of the lower uterine segment was entirely undamaged. In this case rupture must have occurred because of violent manipulations during delivery.

In 1904, J. W. Williams<sup>3</sup> reported the case of a woman of thirty-three years delivered six hours before he saw her by an easy low forceps operation done without anesthesia. She was a primipara and there was no hemorrhage but immediately after labor she complained of an intense tearing pain about the rectum. Morphine was given and she soon passed into collapse. Diagnosis of internal hemorrhage was made and palpation showed that the lower abdomen was filled by a round and fluctuant tumor reaching to the umbilicus, which proved not to be bladder. The uterus was well contracted, surmounting this tumor and there

was marked bulging of the left vaginal fornix with a transmitted fluctuation wave. Diagnosis of hematoma of the left broad ligament was made and though the patient was almost moribund, she was prepared for immediate operation. No communication could be found between the hematoma and the uterine canal, excluding a true rupture. The source of bleeding was found to be an oozing on the inferior surface of the bladder involving no large vessels. Ligature was impossible and the cavity was packed with gauze and the vagina was also packed for counter pressure. This patient rallied and made a satisfactory recovery.

Williams stated that hardly more than 20 cases of intrapelvic hematoma following labor are reported in the literature. The first case described was that of Denenx in 1830 who pointed out that hematomata below the pelvic floor was comparatively frequent but above the pelvic floor was extremely rare. Hugenberger in 1865 reported five cases and collected ten others from the literature, and he says since that time only isolated cases were reported, the majority dying, though a few recovered spontaneously. Williams believed that his was the first case upon which an operation was done. He pointed out that the differential diagnosis of hematoma and incomplete rupture of the uterus is not important because operative interference is demanded in either condition.

Shambaugh<sup>1</sup> reports a case of rupture of a varicose vein in the posterior leaf of the broad ligament during pregnancy with intraabdominal hemorrhage. Symptoms began immediately after intercourse and operation was performed four hours later. This patient recovered. This, however, was a very early tubal pregnancy and not quite comparable to our present case, although he demonstrated that the tear was in a typical varicose vein, showing a thinning of the musculature of the media with occasional absence of the musculature and even of the elastic fibers.

Teller<sup>2</sup> in 1910 reported the rupture of a vessel in the right broad ligament during the course of normal labor. A large hematoma was formed which spontaneously ruptured into the peritoneal cavity with fatal outcome. This patient was forty-one years old, para viii. A distinct fixed tumor appeared at the right of the uterus and a tentative diagnosis was made of an adnexa tumor. This occurred after a normal delivery without unusual loss of blood. Convalescence progressed normally until twenty-four hours after delivery when she became distended, complained of pain in the right lower quadrant, pulse became small and rapid, she began to yawn, grew pale, and was then prepared for laparotomy. A large amount of fluid and clotted blood was removed from the abdomen and there was found a tear five cm. long in the right broad ligament in a transverse direction through which protruded a large blood clot. A diagnosis of spontaneous rupture of the uterus was entertained and a total extirpation of the uterus was attempted. The pulse was scarcely perceptible at the onset of operation and she died before it could be completed. Autopsy was obtained. All the vessels of the pelvis were examined and showed no varices or aneurysms. Examination of the extirpated uterus and right adnexa showed the musculature to be intact which excluded the diagnosis of rupture of the uterus. Cause of death was given as rupture of a varix of the right broad ligament. Microscopic examination of the vessels was normal. There was no manipulation in this case at delivery and the Credé method was not used to express the placenta.

Langes<sup>3</sup> in 1913 reported a woman of thirty-two years, para ii, six weeks before term. She felt a sudden sharp pain in the abdomen as if something tore. This occurred after contractions had been noted for fifteen hours. Pains continued but grew weaker and several hours later she fainted, became pulseless and was brought into the clinic by the midwife. Fetal heart tones were 150, she was two fingers dilated, membranes intact and the breech presenting. Membranes were then ruptured and two liters of amniotic fluid escaped. She became weaker and there

developed dulness in the left flank which lead to an exploratory puncture in this region, obtaining fluid blood. She was immediately prepared for laparotomy and the hemorrhage was found to come from a hole in the serosa of the uterus on the left posterior side about 1 cm. in diameter. This bleeding was controlled and a stillborn child was delivered by cesarean section followed by amputation of the uterus. She died two hours later. Autopsy showed nothing unusual and serial sections of the wall of the uterus were also normal. There were many subperitoneal vessels some of the walls of which were perhaps a little thinner than normal and the rupture occurred in a varicosity which was immediately beneath the serosa. Langes believes that such hemorrhage may occur through external violence, hemorrhagic disease, phosphorus poison, etc., but no such explanation could be found in his case.

Langes noted that there is no sudden cessation of uterine contractions as is the case with complete rupture of the uterus but rather a gradual diminution of contractions. In these cases no external bleeding is observed. The differential diagnosis should consider the simultaneous extra- and intrauterine pregnancies and rupture of some other abdominal blood vessel such as splenic artery or an aneurysm. The chief differential diagnosis he considered to be premature separation of the normally implanted placenta. He noted the following characteristics of the intra-abdominal hemorrhage: (1) sudden tearing sensation; (2) continued labor pains; (3) external tenderness of the uterus; (4) distention of the abdomen, making abdominal palpation of the fetal parts impossible; and (5) increase in anemia. He notes no relationship with nephritis, exophthalmic goiter or other disease. In conclusion he recommends exploratory paracentesis as soon as dulness appears in the flanks. Commenting on Langes' case it is interesting to note that this patient was under observation and could have been operated in ample time to save her life. I believe that the diagnosis should be made or at least entertained before marked dulness appears in the flanks and certainly before the exploratory paracentesis would give results. At such a time the chances of recovery have already been lost.

Tenconi<sup>7</sup> in 1924 reviewed in great detail serious hemorrhage from ruptured vessels of various kinds in connection with pregnancy. He reported a case of a thirty-four year old woman at term, a multipara who presented bilateral inguinal hernia and large masses of varices of the external genitalia. She was under observation in the clinic for several days before labor. She had always suffered from difficulty in respiration due to deficient cardiac action and had to sit up in bed in order to breathe comfortably. She went into labor early in the morning and a few hours later was taken with a sudden attack of shortness of breath and collapse, pulse was over 90 and quite weak. No pain or other symptoms had preceded this crisis. The abdominal walls were very sensitive but uterine contractions had undergone no modification in their rhythm or strength, and there was no bleeding from the vagina. She received supportive treatment with cardiac stimulation and rallied somewhat. At that time the cervix was not open. Toward 4 p.m. she complained again of abdominal pain and became quite agitated. The pulse became more rapid and weak and the abdomen was much more tender to palpation. The membranes then ruptured spontaneously and about three liters of clear amniotic fluid escaped with marked improvement in the patient's comfort. Fetal heart tones were normal. Three hours later she became quite pallid and unconscious. Her pulse could scarcely be counted, respirations were very shallow, and death followed shortly thereafter. A post-mortem cesarean section was done but the child was dead. Autopsy showed over a liter of fluid blood in the abdomen and a break in the peritoneum on the posterior wall of the uterus, just above the uterocervical ligaments, about 1½ cm. in diameter. A probe could be passed immediately into an enlarged vein. Sections of the uterus showed nothing ab-

nificant. Tenzel calls attention to existence of external varices in his case. In all the cases he found in the literature, women were in more or less advanced labor when hemorrhage occurred, and a few had no previous abdominal pain. He discusses also the differential diagnosis and considers exploratory paracentesis as suggested by Langes.

Chauviere in 1891 reported a fatal intraabdominal hemorrhage from the rupture of a vein of the right ovary in a woman aged thirty in the fifth month of her fourth pregnancy. External varicose veins were also noted. She was brought in from the country in a wagon by a neighbor, and complained of severe pains in the abdomen especially on the right side. Death ensued within three hours, the lesion being discovered at autopsy.

Intraperitoneal hemorrhages of this nature associated with fibroids of the uterus were reported by Heerde who collected twelve cases from the literature and added another one of his own.

There are numerous other reports in the literature of abdominal hemorrhage during pregnancy from rupture of the splenic artery, aneurysms, etc., reported by Smith,<sup>10</sup> Simpson,<sup>11</sup> Nelson,<sup>12</sup> Savor,<sup>13</sup> Schwing,<sup>14</sup> Hubbard,<sup>15</sup> LeLorier,<sup>16</sup> Penbert,<sup>17</sup> and Weenbergh.<sup>18</sup>

In this connection it might be well to draw attention to the observations of Bauerlein,<sup>19</sup> Kaufman,<sup>20</sup> Halban,<sup>21</sup> and Falkner<sup>22</sup> who have shown that a marked alteration in the vein walls may occur in the lower uterine segment which predisposes to stolic postpartum hemorrhages and is thought to account for some cervical tears and occasional spontaneous rupture of the uterus. Bauerlein reports such a case of rupture. Kaufman's case showed enormous dilatation of the veins of the body of the uterus. Halban reported enormous dilatation of the veins and capillaries in the uterine wall in a patient three months pregnant. The uterus was obtained for study by a total hysterectomy. Falkner reported finding dilated capillaries and very thin walled veins in a nonpregnant woman of twenty-nine years. The microscopic picture reminded him of a cavernous angioma of the liver.

#### CONCLUSIONS

I have been able to report a case of intraabdominal hemorrhage caused by rupture of a vein on the wall of the uterus during the thirty-first week of pregnancy with operation and recovery. Such cases are extremely rare and always end fatally unless prompt operation is done. None of those found in the literature have survived except in a few instances where a hematoma developing in the broad ligament called attention to the hemorrhage.

The diagnosis of concealed hemorrhage is not difficult to make and probably would be made more often and more quickly if the condition were not so rare and if the physician's attention were not absorbed in watching a process which he fully expects to be physiologic. Physicians are prone to park their powers of observation when attending a confinement.

The chief difficulties in differential diagnosis are to rule out spontaneous rupture of the uterus, though the treatment for both conditions would be operative, and second, to rule out concealed hemorrhage not into the abdomen but into the uterine cavity caused by separation of the normally implanted placenta with hemorrhagic infarction of the uterine wall. Concerning this latter condition many obstetricians feel that

cesarean section is often the procedure of choice, inasmuch as the hemorrhagic infarction of the uterus may be so severe as to preclude the normal contraction and retraction of the uterine muscle necessary for control of postpartum hemorrhage.

It would seem that cases like the one reported usually give a history of (1) acute abdominal pain followed by (2) increasing sensitiveness of the abdomen, (3) signs of internal hemorrhage, and (4) decreasing but unarrested uterine contractions.

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179 ALLYN STREET.

## PUERPERAL GANGRENE OF BOTH LEGS, DOUBLE AMPUTATION. RECOVERY

By R. M. TOLL, M.D., SCRANTON, PA.

**P**ERIPHERAL gangrene as a complication of the puerperium is a very rare occurrence, but a most serious one, ending fatally in more than half the cases. The following case has several interesting features.

Mrs. G. G., age twenty-six, married eleven years, had six children all living and well; two miscarriages. No severe illnesses of any kind. All deliveries were normal. Present one on Feb. 16, 1927, was spontaneous, with no one in attendance. Husband called in a midwife who cut the cord and expressed the placenta. On the third day she got out of bed which she had always done following her other confinements. Next day she had a chill followed by fever. Admitted to the West Side Hospital Feb. 24, 1927.

Examination on admission: a ruddy, plump, well-nourished and well-developed young woman; does not look sick. T. 101°, P. 128, R. 26. Complains of pain in right loin. Abdomen somewhat distended but soft, some tenderness in each iliac fossa. Small amount of offensive lochia. Pelvic examination negative. Heart not enlarged and free from murmurs. Lungs negative. Urinalysis negative. Wassermann negative. Blood count: R.B.C. 4,000,000, W.B.C. 9840, Hb. 80.

Both legs subsequently became involved in an extensive gangrenous process, with marked septic symptoms. Following the appearance of a line of demarcation in

each leg below the knee, amputation under ether with good results and complete recovery. Subsequently she learned to walk with two artificial legs.

Close examination of amputated right leg: specimen consists of a gangrenous leg with a deep wide line of demarcation; skin is broken in several spots; skin of the toes and feet is dry and hard; superficial fascia in the calf necrotic; tendons and deep muscles show extensive necrosis. No thrombi in the arteries or veins but both filled with a viscous bloody fluid. No microscopic examination was made. The left leg showed the same condition.

This case would appear to fall into the class of those due to arterial obstruction from endarteritic changes brought on by infection. In this instance the infection was of a mild type.

Stein's collection together with the cases of Hicks, Entwisle, and the one now reported comprise a total of sixty-six cases of puerperal peripheral gangrene. In the vast majority, fifty-six of the total, the process affected the lower extremities.

## EDEMA OF CERVIX IN PREGNANCY WITH REPORT OF A CASE

By JAMES R. MANLEY, M.D., F.A.C.S., DULUTH, MINN.

A SLIGHT edema and softening of the cervix is normal during pregnancy. It appears during the first six weeks and does not progress further, but the condition of marked edema reported herewith is possibly of sufficient rarity to merit a description.

The patient was a well developed woman, aged thirty two, who had borne three children; the first and second labors were instrumental and very hard, the last one spontaneous. She had one miscarriage between the second and third child at three months. Her last menses started August 14, 1926. She felt fairly well until November when she said that something seemed to protrude from the vagina. She consulted a doctor in another city where she lived at that time, and he told her it was the bladder and inserted several different varieties of ring pessary. The treatment was not very successful. This condition, which was probably a cystocele, continued until about the fifteenth of March when she consulted me stating that now something else had come out of the vagina and that it stayed out all the time and did not go back when she lay down.

Vaginal examination in lithotomy position disclosed a condition which on casual inspection had the appearance of a very marked cystocele and rectocele with an unusual amount of protrusion. Close examination showed this to be a greatly hypertrophied and edematous cervix.

The cervix extended two inches outside of the vulva, was about three inches in diameter, and was four and a fourth inches long. The body of the uterus was high up in the pelvis and did not prolapse. The vaginal fornices were well marked, there was a slight cystocele and rectocele.

The mucous membrane covering the cervix was thickened and whitish in color. It was dry and there was no ulceration.

The patient was not in any great distress and so it was decided to fit her with a cup stem pessary with perineal support. This was done with the result that when she returned in three days the hypertrophy had practically disappeared, the cervix

was about normal in length but was somewhat thicker than normal, it did not protrude on straining, but retained its place high in the vagina.

The patient wore this support until May 1 when she was advised to stop its use as labor was due in about one month. The condition did not recur, she was delivered of a healthy child May 21 with no difficulty.

The literature of this condition is not very plentiful, many of the cases being reported by foreign authors.

Turenne of Montevideo reported two cases in August, 1925, with a fairly comprehensive review of the literature. One of his cases was in labor when seen, the cervix protruded 8 cm. through the vulva during a pain, while the body of the uterus was still high; this case was delivered without trouble, the hypertrophied cervix dilating easily.

The other patient was in her seventh month and because the hypertrophied cervix was infected Turenne was induced to amputate the cervix. Labor soon started and a living child was expelled. However, the woman developed a pyemia and died about three months later with a generalized infection.

Paddock reported a case in which the condition recurred in two successive pregnancies. In the last one, labor occurred during the attack, there was considerable hemorrhage but the outcome was good.

The case of Seitz is often quoted in the literature. In this instance the patient while walking suddenly felt something protruding from the vulva. A midwife incised the tumor thinking it to be the membranes. The patient bled severely and Seitz was called. A tampon stopped the bleeding and a diagnosis of edema of the cervix was made. The rectum was full of hard feces, the bowels not having moved for seven days. After free catharsis the edema disappeared in a few days. After recovery the patient went home but again allowed herself to become constipated when the condition again recurred only to quickly disappear after emptying the lower bowel. In this case the obstinate constipation seemed to be a contributing factor.

Haultain of Edinburgh reports a case in which the patient a twenty-seven-year-old para v was delivered by his students of an 8 pound baby in four hours. Before the placenta was expelled, there was found a large mass lying at the side of the vagina which was found to be the edematous anterior lip of the cervix. The tumor diminished markedly in size during the next thirty minutes and the next morning had entirely disappeared. The etiology of this condition is obscure.

Jolly considers the cause to be of the nature of an inflammatory edema caused by toxins, infection, etc., and to be analogous to angioneurotic edema. He considers that it fits in well with known cases of angioneurotic edema occurring in other regions, and it appears and disappears suddenly, is elastic, causes no pain and leaves no relic behind.

Geyl believes that it is due to interference with the venous return caused by a kink between the lower uterine segment and the cervix. This stagnation might be aggravated by constipation as in the case of Seitz where the edema disappeared on clearing out the lower bowel.

In my case it would seem that the circulatory theory was correct because as soon as the cervix was supported and lifted up favoring free venous return the condition improved, whereas if it had been due to an angioneurotic edema the mechanical support would not have helped.

## PUERPERAL TETANUS IN HAWAII

By GUY C. MILNOR, M.D., HONOLULU

**T**ETANUS is a very prevalent disease in the Hawaiian Islands; much too prevalent if one considers the intelligence of the people and the value of prophylactic inoculations with antitetanic serum. Nevertheless, there have been reported to the Board of Health during the past five years, 103 cases, and since in Hawaii tetanus is not a reportable disease, this means 103 deaths from this disease.

DEATHS FROM TETANUS IN THE TERRITORY OF HAWAII

YEAR	ESTIMATED POPULATION	DEATHS	RATE PER 1000
1923	298,509	21	0.08
1924	307,100	22	0.07
1925	323,645	17	0.05
1926	328,111	21	0.06
1927	333,120	18	0.05

It is very difficult to estimate how many cases of tetanus have recovered in the past five years. A survey of our own records and those of our local hospitals leads me to believe that the death rate is above 92 per cent.

Most cases have their primary focus in puncture wounds of the foot or hand. Some have been found to originate in operative wounds as in hernia incision and upper abdominal incisions.

Puerperal tetanus is less common and a case here cited seems unusual and interesting enough to be reported.

A Japanese woman, aged thirty, after missing her October period, produced an abortion on herself by inserting into the uterus a root of the poha bush, a common shrub grown in the local gardens. This happened on October 15. She began to pass clots on October 19 (4th day) and flowed up to October 29 (14th day), with no complications. On October 30 (15th day) she felt ill for the first time with chills, headache and fever, a slight backache and some peculiar stiff sensations of the jaw. On October 31 (16th day) her backache became severe and her jaw became locked. Typical tetanus spasms began and increased in severity and frequency.

She was first seen November 3 (19th day) and examination showed extreme illness, patient's jaw locked, with spasms every three to five minutes. Temperature was 104° F., axillary. She was fully conscious and was in profuse perspiration. She suffered acutely from pain in her back. Pulse was 120 and weak. There was a dark red vaginal discharge with some odor. An examination showed a retroverted, gravid uterus, with open cervix.

She was given 60,000 units of antitoxin immediately intravenously and sent to the hospital. Morphine hypodermatically, grain  $\frac{1}{4}$ , and chloral by mouth, grains 20, were given. She was then sent to the surgery where a dilatation and curettage were done under chloroform anesthesia. The uterus was thoroughly irrigated with a warm peroxide of hydrogen solution, 50 per cent, followed by irrigation with 25 per cent Dakin's solution. A two-way catheter was inserted within the uterus and fixed there. This was used to make a continuous drip of Dakin's solution into the uterus.



She left the operating table in fair condition at 3:00 P.M., but died at 4:00 A.M. the next day. From the time of the operation until her death she had frequent convulsions but remained conscious until the end.

Here is a case of puerperal tetanus that might have been saved had an early diagnosis been made. Further than that it brings up for discussion again the distribution in China, Japan, Hawaii, and the west coast of the United States, of the various strains of tetanus bacilli, and the inclusions of these strains in the antigens used to prepare the antitoxic sera. Unfortunately, our efforts to isolate the bacillus in this case resulted in failure.

The bacillus perhaps entered the uterus on October 15, grew and began to produce symptoms on October 29 (14th day). The fourteen-day incubation period was of doubtful value with regard to prognosis. After this date her system was so overwhelmed with infection and toxin that the most heroic means would have failed.

One other case of puerperal tetanus has been observed by me. A Hawaiian woman, aged thirty-eight, was delivered of her eighth child in her home, by a physician. A normal delivery was reported. On the sixth day after delivery she had her first sign of tetanus and died three days later. There was no focus of infection on her body such as cuts, puncture wounds, etc. Three days after the death of the mother the child died of tetanus, the infection being on the umbilicus.

401 SOUTH BERETANIA STREET.

## ACUTE LYMPHATIC LEUCEMIA WITH MYELOPHTHISIC ANEMIA COMPLICATING PREGNANCY

BY WM. ALLAN, M.D., CHARLOTTE, N. C.

**L**EUCEMIA as a complication of pregnancy is very unusual, but according to Bower and Clark<sup>1</sup> not as rare as pregnancy occurring in leucemia. Kosmak<sup>2</sup> reviews the reports of three leucemic women<sup>3, 4, 5</sup> who had repeated pregnancies. Between 10 and 20 cases of myeloid leucemia complicating pregnancy have been reported, but there are less than half a dozen reported instances of lymphatic<sup>2, 3</sup> leucemia as a complication of pregnancy, so that the following case seems worth recording.

A white primipara, twenty years old, five months pregnant, was referred to me July 29, 1927, by Dr. R. B. Groves of Lowell. She complained of weakness, shortness of breath, failing vision, and was drowsy and very anemic. Her family and past history were unimportant. She had last menstruated February 18 to 25, 1927, and had suffered with a good deal of nausea and vomiting since the beginning of pregnancy except during the last part of the third and early part of the fourth month. She had noticed increasing paleness since the third month and before admission, examination of her blood showed red cells 464,000, hemoglobin 20 per cent, giving a color index above 2, with white blood count 16,400, polynuclears 32 per cent, small mononuclears 12 per cent, large mononuclears 51 per cent, transitionals 2 per cent, eosinophils 3 per cent. On admission there was striking pallor of skin and mucous membranes but no icteric tint; petechiae were scattered over upper arms and chest. The eye-grounds were full of fresh hemorrhages, particularly along the course of the vessels. Heart size normal with systolic murmur at the base, rate 132, regular, blood pressure 130/55. The abdomen showed uterus reaching to umbilicus; no tenderness or scars. The spleen could not be felt. The peripheral glands were not palpable. Physical examination otherwise negative. The urine showed traces of albumin and sugar, no urobilinogen, and was microscopically

negative. Examination of the blood showed hemoglobin 10 per cent, red cells 625,000, color index 0.84, white blood count 16,000, polymorphs 25 per cent, lymphocytes 75 per cent, eosinophils 2 per cent. Given 600 c.c. of blood by direct transfusion by Dr. H. P. Harts.

July 29, 1927: Leucocytes index 201. The drowsiness and listlessness have disappeared.

August 1, 1927: No vomiting and patient is hungry. Hemoglobin 15 per cent, red count 1,510,000, color index 0.71; individual red cells seem normal; no blasts, white cells 41,000, with polymorphs 16 per cent, lymphocyte 84 per cent. Given a second direct transfusion of 600 c.c.

August 10, 1927: Blood given 1,400 c.c. Examination of the eye-grounds showed capillary hemorrhages in each fundus whereas ten days ago the right fundus was almost entirely covered with retinal hemorrhages and there were a great many hemorrhages in the left fundus. The petechial spots on the upper arms have also disappeared. Several days ago the patient complained that the gums seemed sore to the touch in fitting, but there have been no other signs of hemorrhages. For the past few days the patient has been in the sunshine every morning and her diet has included liver and orange marmalade. Sent home August 11th.

August 20: Re-admitted to Presbyterian Hospital because of nausea and fainting. Given by direct transfusion 600 c.c. of blood. August 23: Given 700 c.c. of blood.

August 24: Hemoglobin 30 per cent, red cells 2,180,000; white count 23,700. August 26: Given 600 c.c. of blood by direct transfusion, and on August 31, 550 c.c.

September 2: Hemoglobin 20 per cent, red count 3,600,000; white count 27,600, polymorphs 20 per cent, lymphocytes 80 per cent.

September 7: Hemoglobin 40 per cent, red cells 3,900,000, white count 37,200, with polymorphs 9 per cent, lymphocytes 91 per cent.

September 8: Hemorrhage into the dorsum of each foot without trauma. Phthalic kidney test 45 per cent.

September 11: Hemoglobin 40 per cent, red count 2,730,000, color index 0.9; white count 44,000, with polymorphs 16 per cent, and lymphocytes 89 per cent, myelocytes 1 per cent. The marrow shows a moderate number of both normoblasts and megakaryoblasts but very little variation in size, shape or staining reactions.

September 13: Reticulated red cells 0.5 per cent as compared with 0.1 per cent a week ago. Blood platelets 70,000.

September 16: Gums bleeding today. Given a seventh transfusion of 758 c.c.

September 17: Induction of labor started. Pains continued until 4:30 A.M., September 18, when she was given morphia. During the night she vomited and complained of substernal pain on inspiration. Uterine pains started again at 5 P.M., continuing for some hours. The substernal pain became more severe, the pulse rate reached 140, regular, blood pressure 128/55; some vomiting with oozing from the gums all day. Delivered by version September 19 at 6 A.M. Child stillborn. Very little bleeding during delivery but about an hour and a half later there was a brisk postpartum hemorrhage and the uterus was packed. After this hemorrhage substernal pain disappeared but the mucous membranes still showed good color. Pulse rate 156, respiration 50, suggesting air hunger. At 10 A.M., given eighth transfusion of 400 c.c. and during this procedure the pulse rate dropped to 138 and respiration to 35. Patient remained comfortable.

September 21: Patient has been rather drowsy with bleeding gums since delivery but otherwise comfortable. Leucocyte count 137,000. Three days later the white count had gone above 200,000 with 97 per cent lymphocytes, and the patient sank into coma with deep, rapid respiration and died. Autopsy not permitted.

An autopsy on the fetus showed nothing abnormal. There was no indication of leucemia in the fetal blood.<sup>6</sup>

*Discussion.*—This patient was at first thought to be suffering from the hemolytic anemia of pregnancy, as this condition is at times accompanied by a considerable increase in the leucocytes<sup>7, 8, 9, 10</sup> generally, however, an increase in neutrophils. Since this hemolytic anemia of pregnancy is curable by blood transfusion this was promptly instituted. The resolution of the retinal hemorrhages, the disappearance of the petechiae, and the decline of the leucocyte count from 30,000 to 12,900 (possibly due to dilution) in the first two weeks after transfusion all looked promising. However, at the end of three weeks it became evident that the patient was making no new red blood cells herself, but was simply living on transfused blood and her leucocyte count was slowly rising with a proportionate increase in lymphocytes. An attempt was then made by four transfusions to give her enough blood to carry on to the end of the eighth month, for the sake of improving the chances of a viable fetus. The hemoglobin and red blood count were brought up to 75 per cent of normal, and declined slowly during the fifth and sixth week of observation. She could have been carried along on transfusions apparently without trouble from the anemia, but during the seventh week of observation the hemorrhagic manifestations and the steady increase in the leucocyte count seemed to demand termination of the pregnancy. Preliminary to the induction of labor she was given a seventh direct transfusion of 750 c.c. which apparently overloaded the circulatory system as shown by the substernal pain which disappeared with the postpartum hemorrhage. Unfortunately, emptying the uterus had no favorable influence on the leucemia, which progressed rapidly to a fatal termination five days after delivery.

The most interesting phase of this case was the relation of the anemia to the leucemia. On admission the symptoms and blood picture were those of a vicious anemia with a mild leucemia. After transfusions had corrected the anemia, it gradually became evident that though red blood cells were not destroyed rapidly, yet practically no new cells were being supplied by the bone marrow. The anemia, then, was aplastic, not hemolytic. In the absence of examination postmortem, it seems probable that leucemic infiltration of the bone marrow crowded out the erythroblastic tissue, producing a myelophthisic<sup>11</sup> anemia.

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# THE PLACENTAL TRANSMISSION OF INSULIN FROM FETUS TO MOTHER

By GEORGE T. PACK, B.S., M.D., and DONN BARRER, B.S., TUSCALOOSA, ALABAMA

(From the Department of Pathology, University of Alabama)

IN 1911, before Banting isolated the active principle, insulin, from the pancreas, Carlson and Drennan conducted a series of experiments purporting to show that the internal pancreatic secretion was transmitted from fetus to mother. When complete pancreatectomies were performed on gravid animals, late in pregnancy, the resultant maternal

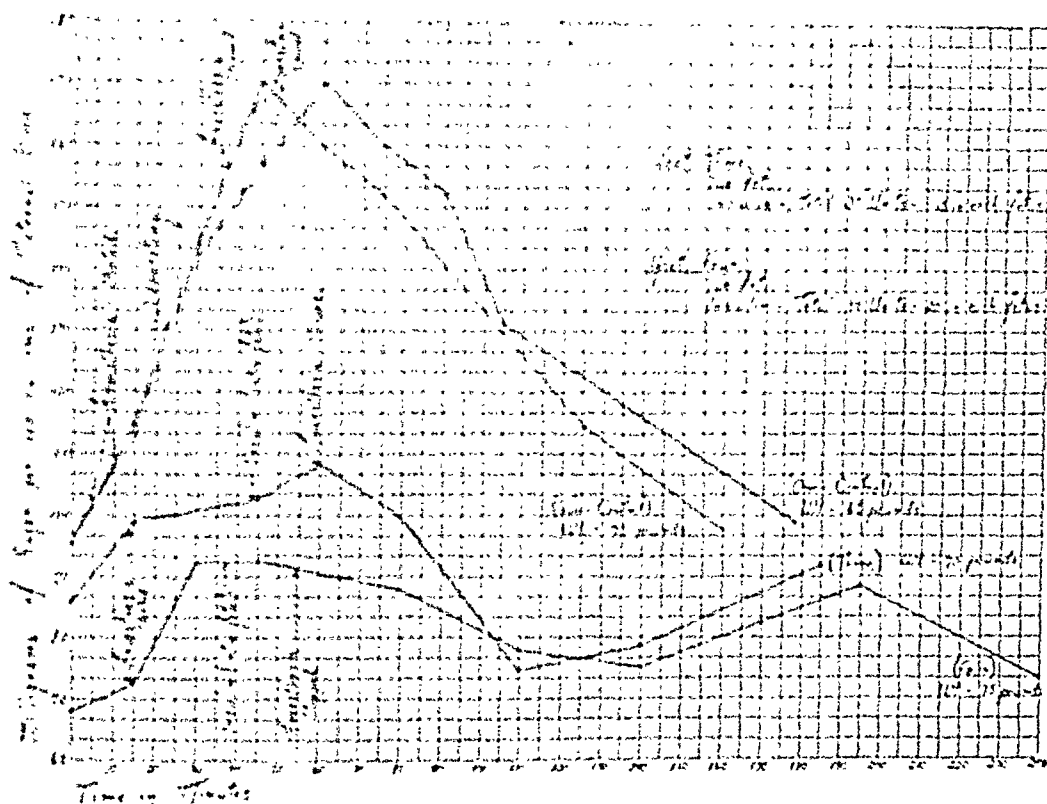


Chart I.

surgical diabetes was controlled to a significant extent by the theoretic passage of this pancreatic hormone from fetal blood through the placenta into the maternal circulation. The well-developed fetus has a pancreas rich in islet cells, and, in fact, was used as a source of insulin during the early days of insulin investigation.

The assertions made by Carlson and Drennan were logical assumptions based on indirect evidence. The research reported in this article was an attempt to obtain conclusive proof of the placental transmission of insulin by the injection of commercial insulin into the bodies of the feti in utero and the concomitant observations of maternal blood-sugar levels.

Cats were first used, but proved unsatisfactory because of their excitability and consequent hyperglycemia. Insomuch as the Alabamian loves his dog too dearly to part with him for research purposes, the goat was substituted because of its availability. It proved to be an acceptable experimental animal.

*Method of Procedure.*—Healthy pregnant goats far advanced in pregnancy were the objects of the experiment. Blood was drawn by jugular venapuncture every fifteen minutes during the course of each experiment, in order to observe any significant fluctuations in the maternal blood sugar. Blood-sugar estimations were made according to the Folin-Wu technic. After the determination of the normal blood-sugar level of each goat, ether anesthesia was induced. Previous attempts to

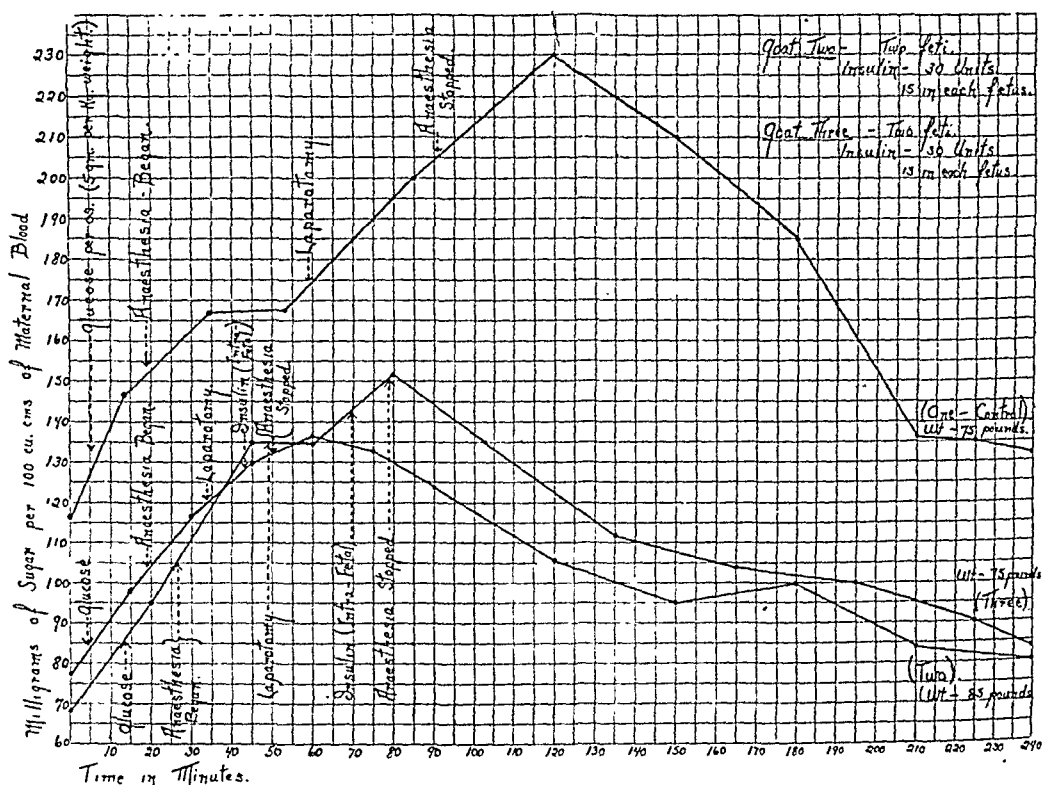


Chart II.

employ local anesthesia (novocaine) and chloroform were found to be less satisfactory than ether. With anesthesia established, a low midline laparotomy was performed, the uterus palpated and the feti counted. Then using a long finely-bored needle plugged with sterile vaseline, insulin was injected through the uterine wall into each fetus with as little trauma as possible. In no instance was hysterotomy performed. No insulin was lost in the peritoneal cavity, and the surgeon felt reasonably certain that the entire amount was introduced intrafetal. Immediate layer closure of the abdominal wound was followed by the withdrawal of ether. Aseptic precautions were used in every case and all the animals survived the operation several months, although they always went into premature labor sooner or later, and gave birth to dead feti, which had probably died from hypoglycemic shock.

Ether anesthesia elevates the blood-sugar concentration to the upper limit of normality and even beyond the renal threshold so that glycosuria may occur. (See Control-Chart I.) Insulin has far greater potency

in reducing hyperglycemia to normal than it does in converting the normal blood sugar to hypoglycemic levels. On this account, it was believed that an experimentally produced hyperglycemia of alimentary origin would furnish a more delicate indicator of insulin action. Accordingly five grams of glucose per kilogram of body weight of pregnant goats were given by stomach tube and the sugar-tolerance control obtained on several animals (See Control-Chart II.)

The results in both series of experiments were informative and significant. There is some disparity in the initial readings of the control and experimental animals, particularly in Chart II, but no more than the limits of normality permit. The ascents of the blood-sugar curves behave similarly in both series of experiments, i.e., with and without glucose, and one can readily perceive that the intrafetal injection of insulin is shortly responded to by a resultant lowering of the maternal blood sugar.

For comparative purposes we include the following protocol of a control experiment in which the goat was nonpregnant and received insulin intraperitoneally. The goat was a young animal, weighing fifty-five pounds.

TIME	MG. OF SUGAR PER 100 C.C.M. OF BLOOD	REMARKS
9:25 A.M.	78.4	Normal
9:30 A.M.		Glucose—5 gm. per kg. of body weight
9:40 A.M.	98.0	
9:45 A.M.		Ether anesthesia started
9:55 A.M.	113.6	
10:10 A.M.	130.7	
10:15 A.M.		Laparotomy
10:30 A.M.	137.9	Insulin intraperitoneally. 30 Units
10:50 A.M.	133.0	Wound closure. Anesthesia ended
11:05 A.M.	113.0	
11:25 A.M.	106.0	
11:55 A.M.	96.0	
12:30 P.M.	101.0	
1:00 P.M.	85.5	
2:00 P.M.	81.3	

#### CONCLUSION

Insulin is transmitted through the placenta of the goat from fetus to mother, as determined by variations in maternal blood-sugar levels following intrafetal injection of commercial insulin.

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# A NEW METHOD OF REMOVING A LARGE ABDOMINAL TUMOR THROUGH A SMALL INCISION IN THE ABDOMINAL WALL

By ARTHUR STEIN, M.D., F.A.C.S., NEW YORK

ONE of the disadvantages of removing large abdominal tumors is the extensive incision which we are frequently obliged to make into the abdominal wall in order to deliver the growth. In order to deliver the tumor through the smallest possible abdominal incision, I have been employing a simple maneuver which, so far as I know, has not yet been described.

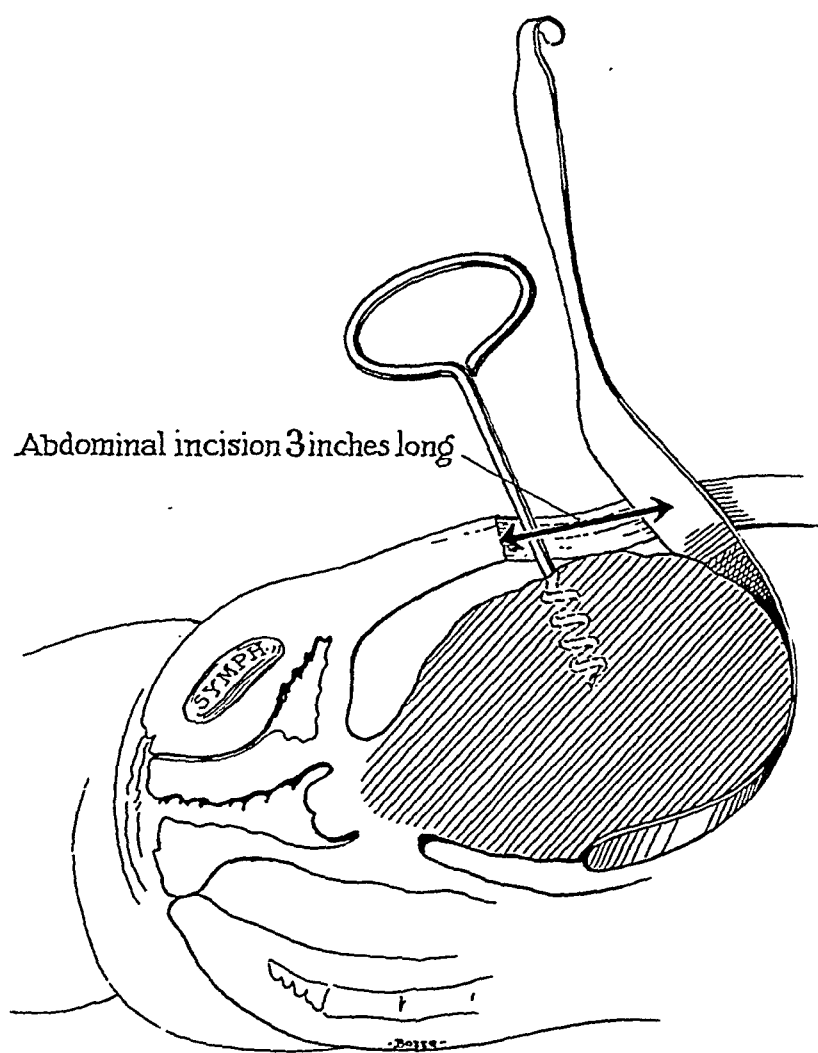


FIG. 1.

Instead of attempting to deliver the growth with the hand by passing the fingers around one of its poles, I use a No. 3 or 4 Deaver or Fritsch retractor. The blade of the retractor is passed around the growth so that the pole lies in its concavity. The difference between the thickness of the retractor and that of the hand is so considerable as to allow of a smaller incision when the instrument is used. While traction is made on the retractor, an assistant presses against both sides of the

patient's abdomen so as to facilitate delivery. Frequently this maneuver is successful in delivering the growth from the abdomen through a surprisingly small incision.

When the tumor is bound down by numerous adhesions, the method is not available, unless the adhesions can be separated first. The types of neoplasms for the removal of which it is most applicable are large uterine fibromyomas or ovarian cysts, when it is not advisable to aspirate the contents before removal.

48 EAST SEVENTY-FOURTH STREET.

## A SIMPLIFIED POWDER BLOWER\*

BY MAX SCHNEIDER, M.D., NEW YORK

(Assistant Adj. Gynecologist, Sydenham Hospital)

MANY cases of leucorrhea are markedly benefited by the so-called "dry treatment," which consists of thoroughly covering the vaginal mucosa with certain astringent, antiseptic, and moisture absorbing powders. These envelop the bacteria and through hygroscopic action deprive them of the moisture necessary for their existence. Thus, powders may almost have a direct curative effect upon the most frequent cause of leucorrhea, namely, bacterial infection. Furthermore, the powder treatment gives immediate subjec-

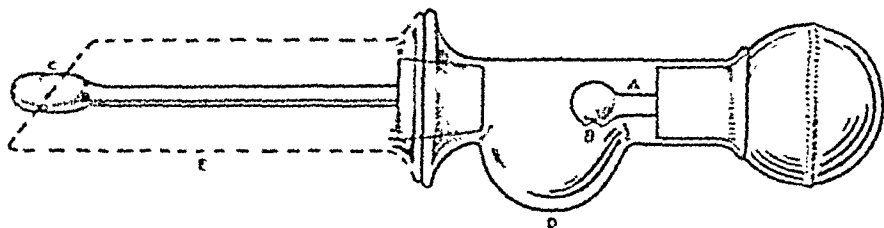


FIG. 1.

tive relief to the irritation accompanying a vaginal discharge by diminishing the amount and neutralizing the acidity.

The following is a description of a simplified powder blower, which can be easily constructed. It consists of:

1. A breast pump with small glass protector (*A*) in rubber bulb. In the latter there is small perforation (*B*) for the expulsion of the air.
2. Glass tubing, six (6) inches long, and  $\frac{1}{4}$  inch in diameter.
3. A rubber stopper,  $\frac{3}{8}$  inch in diameter, with one perforation large enough to hold the glass tubing.
4. A rubber bulb from a medicine dropper, in which small openings are made for the expulsion of the powder in all directions. This is placed over the outer end of the glass tubing. For this bulb, one may substitute a tubing which has a dilated end with small openings (*C*), as used in the vaginal douche nozzle and as illustrated in the diagram.

The rubber stopper containing the glass tubing is inserted into the large open end of the breast pump.

\*This powder blower can be obtained ready-made from Becton Dickinson Co.



The small glass protector (*A*) is so placed, that the aperture (*B*) is directly above the proximal end of the powder receptacle (*D*). The latter is then filled to three-quarters of its capacity with the powder to be used and the apparatus is ready to function as a powder blower. (Gelhorn recommends equal parts of kaolin and sodium bicarbonate as a very efficient powder.)

It is advisable to use the Ferguson or tube speculum (*E*) with this method of treatment.

The advantages claimed for this instrument are evident, namely:

1. Easily constructed at a low cost.
2. It produces a powdery spray in sufficient quantities and in all directions.
3. Ease of sterilization and cleansing.

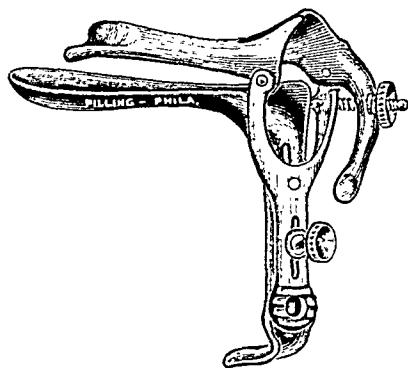
115 EAST NINETIETH STREET.

## A MODIFICATION OF THE BIVALVE VAGINAL SPECULUM

BY J. BERNARD BERNSTINE, M.D., AND THAD L. MONTGOMERY, M.D.,  
PHILADELPHIA, PA.

*(From the Department of Obstetrics, Jefferson Medical College)*

FROM our experience with the bivalve vaginal speculum, particularly in pregnancy, we believe that the anterior blade is better adapted to the contour of the cervix if it is concave at the tip instead of convex. While the posterior blade fits naturally into the concave space of the posterior fornix, the convex tipped anterior blade is opposed to the convexity of the cervix, and in the pregnant woman, to the convexity of the lower uterine segment.



As a result, the anterior blade on being opened first tends to push the cervix upward and posterior; it then scrapes by the anterior lip and imbeds itself in the anterior vaginal wall and lower uterine segment. Thereupon the cervix wedges itself farther and farther down between the two blades and becomes edematous and cyanotic.

This situation has perhaps no serious import during a brief exposure; in those cases however in which it is desired to treat disease, the necessarily more prolonged constriction and congestion of the soft pregnant cervix between the two blades, with the impingement of the anterior blade upon the lower segment may become so.

In an endeavor to obviate these undesirable features we have devised a modification of the anterior blade of the Graves type of speculum.

The modified blade is concave at its distal extremity and gently curved to adapt it to the rotundity of the cervix. Starting about one inch from the distal extremity, the superior aspect has been made concave from side to side and sloping from above downward to accommodate it to the anterior vaginal wall and lower uterine segment.

The resulting instrument has proved a true retractor of the vaginal walls, exposing the cervix without pressure or trauma and not impinging on the lower portion of the pregnant uterus. The instrument may be placed in the vagina, opened, and left in position without discomfort to the patient or danger of irritation while treatment is being proceeded with.

We have found the modified speculum no less useful in the examination and treatment of the gynecologic cervix. The principle is here no less applicable, for the convexity of the anterior wall of the cervix and uterus adjust themselves better to this concave tipped instrument.

2007 PINE STREET.

1426 SPRUCE ST.

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### Erratum

In the article by Breekinridge, entitled *A Frontier Nursing Service*, June, 1928, issue, in the third paragraph, page 867, the fifth sentence should read: Their median intelligence quotient was 99.6.

# Society Transactions

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## OBSTETRICAL SOCIETY OF PHILADELPHIA

MEETING OF OCTOBER 6, 1927

DR. STEPHEN E. TRACY and DR. ARTHUR FIRST presented a paper entitled **A Review of One Thousand and One Obstetric Cases.** (For original article see page 51.)

### DISCUSSION

DR. LONGAKER was particularly interested in the six cases of premature separation of the placenta and especially in the one which came to the hospital in a moribund condition. While he knew nothing of the individual characteristics of this particular patient, he thought the number of six cases of premature separation in 1001 cases was very large. There may be such a thing as a partial separation of a normally situated placenta. He did not think, however, that this term covered those very serious cases of premature separation of the placenta which he considered the last single case to be. Cases of abruption of the placenta form a thoroughly grave and formidable lesion. In this connection he wanted to refer to a recent case under his observation at the Kensington Hospital, very similar to the last one of this list of six cases. It should be borne in mind that the real cases of abruption of the placenta are toxic and in this case there was an actual mistake in diagnosis and a mistake which resulted in a calamity. This patient had a marked hypertension, was toxic, with systolic pressure 190. She was in very severe constant pain. She remained under the care of the house doctor under the impression that she was a case of eclampsia; instead, the patient went into syncope and continued in this condition with intense contraction of the uterus, non-intermittent, hard as a board, very tender, in which condition she was found some hours later, and pulseless. The only thing which could then be done was a section, followed by blood transfusion. The uterus had a gangrenous look when incised. The placenta was completely separated and the muscle layers dissected up and infiltrated. Nothing could save such a patient, even though the diagnosis was promptly made, short of section with hysterectomy. She rallied but died eight hours after delivery by section. She was pulseless at the time and the operation was like cutting through a cadaver. There was not enough blood left in her veins to cause any loss of blood whatever. His impression is that real cause of abruption of the placenta are infrequent and they occur in toxic cases; prompt operation is the only thing.

DR. J. O. ARNOLD wished to commend the paper from another standpoint, namely, that of reporting large series of cases in the various fields of our work in the different institutions, just as they come, and just as they are—good, bad and indifferent—so that all may draw their own conclusions, rather than the tendency to select and report only such cases as seem to support some preconceived notion or theory.

DR. FIRST said that one of the very interesting features is the low percentage of cesarean sections, 5 in 1001 cases. This is very unusual, especially when we

consider that at some institutions the statistics show one cesarean in every 18 or 20 cases. Ten of the cases reported had previously been delivered by cesarean section; they were delivered subsequently *per vaginam* after a labor of from twelve to twenty-four hours. They had a number of cases of definitely contracted pelvis. Several women who were told in other clinics that they would have to have cesarean section and the results reported clearly show the success of this conservatism.

DR. TRACY (closing) said that the credit for this work is due to the members of the staff. Had the collection of cases stopped at 1000 instead of at the end of the year the maternal mortality would have been just one-half that reported, as the last patient in the series did not survive a double pneumonia engrafted on a badly crippled heart.

These figures from the Post-Puerperal Clinic show what can be done for these women with proper treatment after they leave the hospital. There were 39 per cent of retrodisplacements of the uterus in the first 100 patients who reported at the clinic. With the elimination of the abdominal binder after twenty-four hours, the frequent change of positions and the knee-chest position morning and night, the incident of retrodisplacements was reduced 44 per cent.

When the patients can be made to realize the importance of following closely the instructions given, the results will be decidedly better. Many patients disregard all instructions as soon as they leave the hospital.

DRS. L. K. FERGUSON and J. T. PRIESTLEY presented a paper entitled **The Relation of Gall Bladder Disease to Pregnancy With Special Relation to the Factor of Hypercholesterolemia.** (For original article see page 82.)

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## NEW YORK OBSTETRICAL SOCIETY

MEETING OF DECEMBER 13, 1927

DR. D. N. BARROWS (by invitation) presented a paper entitled **Olshausen's Operation for Retroversion, a Comparative Study of Anatomical End-Results.** (For original article see page 61.)

### DISCUSSION

DR. G. G. WARD said that judging from the figures presented, the Montgomery-Simpson operation stands out very well indeed. The advantages of the Olshausen operation in the opinion of Dr. Barrows is that it is so much simpler and easier to do. That we have to grant, but, personally, he felt that the disadvantages to the Olshausen operation greatly outbalance the advantages when compared to the Montgomery-Simpson operation.

Another objection to the Olshausen operation is that it is practically similar, in the terminal results, to the old Gilliam operation in so far that it divides the abdomen into spaces, and Dr. Ward was quite sure that those who have operated over many years have all had experiences of the gut or omentum getting caught following a Gilliam operation. While this does not happen very often, still there is an anatomic condition left that is not ideal, as compared to shortening of the round ligaments in their normal direction, from the horn of the uterus to the internal ring as is done in the Montgomery-Simpson operation. For that reason he preferred

the Montgomery-Simpson operation or some similar type of operation, even though it is more difficult to do in some cases.

One of the points that Dr. Barrows brought out was in regard to a subsequent hernia. It would seem that with a silk ligature one could quite readily strangulate some of the fibers of the rectus muscle sufficiently to cause trouble.

DR. B. P. WATSON mentioned one anatomic point which has a bearing on the selection of the operation, namely, the level of the insertion of the round ligament into the uterus. If the insertion of the round ligament is low, the Olshausen operation or the Montgomery-Simpson operation will not give the result that a Baldy-Webster operation will, if the ligature is brought through and fastened well up on the back of the fundus. Dr. Watson used the Montgomery-Simpson operation very extensively and if the ligament is brought from the rectus muscle and stitched onto the under surface of the rectus sheath, there will be no pain afterwards and no trouble from the point where the ligament is fixed.

DR. BARROWS (closing) said that in six cases, in which he used chromic catgut to perform the Olshausen operation, he had four unsatisfactory results reported. Of course, the anatomic objection is the same as in the Gilliam operation. The hernia problem could be avoided by care in the insertion of the stitches.

The individual operator in each instance attempted to use the type of operation best adapted to the case, and in that way the three types were obtained from the same service. He believed that this operation is very useful in the presence of a cystocele, the principle being the same as in the Frankl operation, only on a modified scale. It may be especially valuable in cases of hysterectomy for this purpose.

DR. H. B. MATTHEWS AND DR. V. P. MAZZOLA (by invitation) presented a paper entitled **Observations on the Biochemical Changes in the Blood Following Radium Therapy, A Report of One Hundred Irradiated Cases.** (For original article see page 97.)

#### DISCUSSION

DR. V. P. MAZZOLA opening the discussion, said:

"A few years ago in a number of cases in which we employed radium, several had nausea and vomiting, a clinical entity, which we called radium sickness. Owing to the fact that this clinical entity was more or less inconstant, and owing to the fact that we employed various methods of treatment by alkalization and dietary measures and still we had the so-called entity of radium sickness, we endeavored to try to find out what the etiology of the so-called clinical condition was in order that we could then employ a scientific method of treatment. At that time, the thought came to us that we would check up the blood chemistry in an attempt to ascertain if in a series of cases there was any change in the nitrogenous products, so we carried out the study that Dr. Matthews has reported to us tonight. The series is a very limited one, and we cannot conclude anything definite from it, but it gives an idea of the changes that take place in the blood. At the same time it gives a clue that the reaction in itself is not the result of the said changes.

"In reviewing our data we failed to bring out the study of the blood chemistry about a week to ten days following irradiation. We thought at that time that information was not necessary because the changes in the blood chemistry immediately following irradiation were not the changes that we get following a nephritic condition, that is, a nephritic irritation, so we did not believe at that time that it was necessary to check up the blood chemistry about ten days later. However, such information would help us in a way to find out whether this increase

in urea was a persistent factor or not. The changes we found were present both in the benign and in the malignant conditions, and they were rather constant for urea.

"The slight changes we found in creatinine were so small that we attribute them to the reading of the colorimeter because two people could read a certain color and there would be variations of four or five points.

"As to the  $\text{CO}_2$  combining power: we endeavored at the time to find out what the alkaline reserve was before and after irradiation. We found that before irradiation it was normal and following irradiation it was within normal limits, and this gave us the idea that no acidosis was present."

DR. G. G. WARD said that in his radiation work, radium sickness followed more frequently in those cases in which the radium was applied to the fundus of the uterus than if only to the cervix.

DR. G. L. MOENCH said that the symptoms which so often follow x-ray or radium applications are probably not due to changes in the urea, but the expression of some disturbance of which the urea imbalance is only a part. In working with the x-ray he found it rather easy to pick out those cases which are going to have a marked reaction. It depends (and this coincides with what Dr. Ward has said) on just how hard the intestine is hit. We can give a huge dose on the chest or on the leg with practically no intoxication, but when we x-ray the abdomen we get in most cases a very marked reaction. Naturally the severity of the reaction depends somewhat on the individual sensitiveness of the patient, but, as a general rule it is true that the stiffer the dose the greater the reaction.

Investigations have been made by Bruegel (*München. med. Wchnschr.*, 1917, p. 379) which show that there are definite changes in the gastric and intestinal secretory processes following the application of x-ray or radium. He considered it would be of interest if Dr. Matthews would classify his cases, both as to dosage and point of application of the radium, that is, its relation to the intestinal tract. If, for example, we are dealing with a small uterus with the intestines close by or even adherent to the uterine body, we would expect to get a marked reaction, whereas a fairly big, lumpy fibromyoma in which the radium is applied only to the endometrium, would put a thick layer of tissue between the source of the radiant energy and the intestines and thus prevent the occurrence of marked toxic symptoms.

DR. W. P. HEALY AND DR. MAX CUTLER presented a paper entitled  
**Relation Between Structure and Prognosis in Cervical Carcinoma Under Radiation Treatment.** (For original article see page 15.)

#### DISCUSSION

DR. A. PLAUT, Pathologist to the Woman's Hospital, spoke by invitation, and said that about four years ago, when Dr. Ward asked him to help the surgeons in the Woman's Hospital by grading carcinoma of the cervix on biopsy studies according to Martzloff's types he bluntly refused, stating he was not in a position to do so. Otherwise he would have graded the highly radioresistant squamous cell carcinoma as favorable and from a general biologic standpoint it seemed impossible that such a complex thing as malignant disease could be classed prognostically in such a simple way.

Going deeper into the matter he soon found himself at an impasse. For tumors which promised a fair result, according to Broder and Martzloff, on account of being highly differentiated, had to be considered resistant against radiation according to the widely accepted law of Bergonia and Tribondeau. On the other hand highly anaplastic carcinomas which were deemed very unfavorable were re-

ported melting away under radiation. Thus, a case had to be called favorable from one standpoint and unfavorable from another. The result of the investigation at the Woman's Hospital was negative as far as histologic prognosis is concerned. Neither the classification of Broder and Martzloff nor any other classification ever brought forward seemed to give a means of making a prognosis. He considered all imaginable histologic features of the carcinoma, not only the type of cell but the architecture of the whole growth, its relation to the stroma, the character of the stroma, the amount and character of inflammation, and so on. Neither any single one of these features nor any group of them seemed to be characteristic of either favorable or unfavorable cases.

After having obtained this negative result Dr. Plant went over all the slides again and classified them simply as regular, fairly regular, irregular, and very irregular. This classification was made after a rapid survey of the slide, from the general impression, not relying on any single feature. This very simple device seems to coincide with the classification used by Drs. Healy and Cutler. The same classification was used many years ago by Schottlaender and Kermauner in their classical work on carcinoma of the uterus, who decided against the feasibility of histologic prognosis.

In the Woman's Hospital, the poor results in young women were very striking. In eleven patients under thirty years of age, one lived two years and four months. All the others died before ten months elapsed. The histologic type in these cases was not uniform. Thus the constitutional factor of youth seemed more important than the histologic structure.

One histologic point cannot be omitted; many carcinomas are very anaplastic but must be called squamous cell carcinoma nevertheless. Their cells are large with distinct outlines, their arrangement corresponds fairly well to the upper layers of the skin, but the differences in size, shape, and mass relation of nucleus and plasma indicate the high degree of anaplasia. Dr. Plant was certain that such cases will react well to radiation but I did not see how one can keep them out of the squamous cell carcinoma in histologic classification.

The outstanding practical question is the following: Do Dr. Healy and Dr. Cutler recommend a biopsy and then decide whether surgery or radiation should be employed? In his opinion it follows logically from their paper that cases should be handled that way in order to do the best science can do for our cancer patients at the present time.

DR. HAROLD BAILEY said that this is a progressive step which will aid in determining what should be done in any particular case.

At the Memorial Hospital, during his service under Dr. Ewing, he became familiar with the three types of cancer the doctor has outlined. The first type used to be called acanthoma, the others plexiform epithelioma and that with marked anaplasia.

The difficulty with a study of this kind, in which we outline the prognosis, lies in the fact that it is necessary to give the full dose of radium, that is as much as the patient can really stand. For instance, in the plexiform epithelioma, although we know it is susceptible to irradiation, nevertheless, as it already extends into the lymphatics, we must give as much radium as possible in order to get as far away from the center of the cervix. Dr. Bailey called attention to another type, the embryonal type of cell, which readily succumbs to irradiation but even after three months, metastasis has already extended well out in the pelvis, and although the nearby tumor is affected by the radiation, the outskirts are still involved.

DR. G. L. MOENCH warned against too great an optimism regarding the probable results of any particular form of treatment in any particular type of tumor. It

has been attempted time and again to diagnose the degree of malignancy of a given tumor from its histologic picture, but always without success because malignancy after all is not only a morphologic but also a clinical concept, and depends very much upon the resistance which the patient's natural protective forces offer to the growth. It may be that Dr. Cutler's figures really include these differences in resistance of the individual patients inasmuch as his failures may represent not only the far advanced cases, but also those in which the resistance to the carcinoma was low. Another series of cases might result in different percentages of cures.

Some years ago Schottlaender (*Strahlentherapie*, vol. 5) reported a case of uterine carcinoma treated with radium in which a hypogastric lymph node involved by the carcinoma also showed the definite histologic changes usually accepted as typical for a radium reaction. Schottlaender interpreted these changes as being actually due to the radium and drew the conclusion that radium really acted on tissues at a greater distance than was generally believed and further that carcinoma metastases did not always offer a marked resistance to radiant energy. A short time after this Dr. Moench saw and published (*Ztschr. f. Geb. u. Gynäk.*, vol. 80) a case of plexiform uterine carcinoma which had never received any treatment of any kind and still showed the typical reaction ascribed to radiation. Schottlaender's deductions were thus more or less weakened since Dr. Moench's report showed that at times a patient, even without any treatment might in her own body develop enough resistance to affect a carcinoma in a manner similar to that of radium and that this is a point which, after all, has to be taken into consideration. We cannot and must not cling too strictly to any classification of tumors and say this type under a certain form of treatment is going to get well in this individual patient, and another type is not going to get well with the same treatment in a second patient because, after all, the patient is the primary consideration and the tumor secondary. Again, mixed types of carcinoma occur, that is tumors showing unripe, medium ripe, and ripe areas and here didactic principles of treatment must fail.

DR. I. C. RUBIN asked whether these classifications apply in the strictest sense to all the tumors examined. This will have a direct bearing in biopsies, whether we strike a portion of the tumor which happens to have a preponderance of the anaplastic, or the plexiform, or the epidermoid, or the epithelioma type.

DR. G. G. WARD called attention to the fact that when Dr. Plant studied the cases at the Woman's Hospital on the basis of Martzloff's classification, he brought out the point Dr. Rubin just mentioned, namely, the question of how he was going to give a classification from biopsy material that would be definite, as there might be a very different condition in that part of the cervix not examined; in other words, that unless he could have the entire cervix to study it would be very difficult for him to classify the exact type of disease because it varied so in different parts of the organ.

DR. A. PLAUT referred to a typical microscopic section from the body of the uterus, which is made up of equal parts of solid carcinoma, similar to the plexiform type, of definite adenocarcinoma, and of hornified squamous cell carcinoma. This is not a very frequent occurrence, but the cases that Dr. Rubin just mentioned of adenocarcinoma of the cervix, secondarily solid, are very frequent. One might conclude from the uniform results Dr. Cutler has shown that these occurrences are not very frequent, otherwise he could not have such constant results in his tables. Dr. Plaut said he saw rather frequently adenocarcinoma which is secondarily solid, and he could not tell from the biopsy how far the tumor is composed of anaplastic parts and how far of highly differentiated parts.



DR. W. P. HEALY said it was evident that every man who has been treating carcinoma of the cervix with radiation therapy was getting results that were confusing. It was evident to him at the end of five years of observation at the Memorial Hospital that there was something in the results that we should be able to explain and that that explanation could only be given, however, by some one who was competent to study the cellular pathology of the cases and then work on the clinical side in trying to establish some deductions.

Dr. Healy considered they were fortunate in being able to compare statistics with those published by Martzloff, of Johns Hopkins, and the Mayos on the surgical treatment only, and that we must bear in mind in the future handling of cases of carcinoma of the cervix that if we are going to consider surgical treatment for even incipient carcinoma of the cervix, we must rule out the anaplastic group (because of only 9 per cent of favorable results in the early cases in that group), but you must also be prepared to meet with a high mortality as the result of operation, which is absolutely ruled out by radiation therapy in all early cases. Dr. Healy felt that there is not going to be any question about how the cases should be treated; that surgery is not going to come into play at all as the method of treatment of carcinoma of the cervix.

As to the difference in the graduation of the different groups and the difficulty of deciding sometimes in which it comes. Dr. Healy claimed there is no difficulty between Group I and Group III. The only difficulty is sometimes in deciding whether a case is plexiform, bordering on Group I, or plexiform, bordering on Group III. You may occasionally get a slide such as Dr. Plaut has alluded to, showing three different types of structure, but that is an anomaly, it is a rare occurrence, and does not enter into consideration in the final statistics.

In answer to Dr. Ward, Dr. Healy stated that they do several biopsies, sent in at different times to the laboratory, for checking up, and it is the most remarkable thing that there seldom is any question in the real outstanding cases. As far as the embryonal type is concerned, about which Dr. Bailey asked, Dr. Healy said they had discarded that term entirely; it means the anaplastic, the highly malignant third group.

DR. CUTLER (in closing) said that in regard to age, their cases failed to show any definite relation between age and prognosis, and for that reason he did not refer to it. The question that Dr. Moench raised as to the resistance of the patient is something all recognize. We know that the general condition of the patient is one of the important factors in determining the prognosis. Many of these patients come in very sick, and their general condition is poor, but the fact remains that a high proportion are cured.

In answer to Dr. Rubin, he would say that no great advances have been made in the morphologic classification of carcinoma of the cervix. In fact our classification corresponds identically with one of the very earliest classifications, namely, that of Chottlaender and Kermauner. The full significance of the relationship between these well recognized structural groups and their prognosis under radiation therapy is relatively new. As to adenocarcinoma of the cervix, they were surprised to find that of seven cases in which this diagnosis had been made, six were found to be endometrial in origin. Consequently there was only one case of true adenocarcinoma of the cervix.

We then recognized that tumors presenting this structure have invariably done badly under surgical treatment. Dr. Cutler said his interest in beginning this problem lay not so much in the clinical aspect of the subject as in its biologic phases. At the Memorial Hospital they were impressed with a group of very remarkable tumors commonly found in the tonsil, nasopharynx, and base of the tongue. Tumors in these locations present peculiar and specific histologic features,

are accompanied by a definite clinical course and display a marked susceptibility to radiation. They differ, therefore, in three important ways from squamous carcinoma, which is the common variety of intraoral lesion. Under the belief that these tumors possibly arise from transitional cells, commonly found in the crypts of the tonsil, base of the tongue and nasopharynx, the term transitional cell carcinoma was applied to them. It was later found that identically the same tumor had been described in 1921 by Schminke and by Regaud under the term lymphoepithelioma but had not been recognized in this country.

These tumors are very malignant, are highly radiosensitive and invariably recur and disseminate widely after surgical interference. The resemblance between the histologic structure of the anaplastic transitional cell carcinoma and certain carcinomas of the cervix was so impressive that it was believed that the same biologic principles could be applied. The results obtained are, therefore, not surprising but follow in logical sequence the same biologic principles which are encountered in tumors in other locations. The important question as to whether the most malignant type of carcinoma of the cervix was actually accompanied by the best prognosis under adequate radiation must be answered in the affirmative.

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## CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF NOVEMBER 18, 1927

Dr. JOSEPH L. BAER presented a specimen of *Fetus Papyraceus*.

This specimen shows how clearly the fetus can be distinguished. The atrophic placenta is well defined, measuring 8 by 10 cm., and both fetus and placenta are firmly attached to the membrane of the full-term placenta. X-ray of the fetus, the age of which is approximately fourteen weeks, shows a complete skeleton.

Dr. J. B. DeLEE demonstrated a means of *Rupturing the Uterus by Injection of Ether*.

He stated that in a previous meeting of the Society Dr. DeTarnowsky presented a method of producing abortion by injection of ether into the uterus. It appeared to the speaker that that was a rather dangerous procedure and after its publication he felt that something should be done to call attention to the dangers. Dr. DeLee demonstrated how the uterus might rupture following injection of ether. Into a Doremus ureometer he poured some water at a temperature of about 100°. He then injected 1 c.c. of ether, following which the maximum expansion of the ether was visible. One cubic centimeter of ether makes about 40 c.c. of gas. When a few more cubic centimeters of ether are injected it is only partially vaporized. When it is fully vaporized it will push the water out of the tube. The point he wished to make was that expansion of ether in the uterus is sufficient to rupture it if the cervix is obstructed by a blood clot or a fold of mucous membrane or if the tubes are closed. Whatever expansion of ether would take place through the patent tubes and the peritoneal cavity could not escape if the tubes were blocked.

Dr. N. S. HEANEY presented a specimen of *Misplaced Endometrial Tissue*.

The patient was a married woman, twenty-nine years of age, who came in complaining of dysmenorrhea. Seven years previously she had an "appendectomy"

before which time she had never had pain at menstrual periods. After that she began to have pain in the appendix incision, which became worse as time went on. At menstrual periods the area of the scar became red and then slowly turned blue after the period was over.

On examination the uterus lay over toward the scar. The scar and the uterus could not be separated during the operation. The left ovary contained a dermoid cyst and also evidence of endometrial cysts. The uterus contained adenomata in anterior wall. Both tubes had been previously removed. The blue area in the scar was an endometrioma.

This was the ninth case Dr. Heeney had had of abdominal wound invasion with endometrial tissue.

### DR. IRVING STEIN presented a new **Self-Retaining Instrument for the Patency Test and Iodized Oil Installation.**

The description of this instrument was published in the *AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY*, vol. xv, May, 1928, page 707.

### DR. DAVID A. HORNER reported two cases of **Inversion of the Uterus During Laparotrachelotomy.**

With an increased number of cesarean sections being performed by all sorts of operators many complications can be expected. The first case was delivered by Dr. Horner and the second by Dr. Rubovitz. Both had identical features. Both were low cervical cesarean sections. In both cases the inversion was caused by traction on the cord for removal of the placentas. Both were originally diagnosed as tumors of the uterus attached to the placental site and it was not until the invagination of the fundus was ascertained and subsequent separation of the placenta from the inverted uterus that the diagnosis was really made. They were both easily corrected by enlarging the incision through the contraction rings upward into the upper uterine segment. Both patients made uneventful recoveries, Dr. Rubovitz' patient leaving the hospital on the fifteenth day and Dr. Horner's on the twelfth despite a copious hemorrhage at the time of operation. After an extensive investigation of the literature nothing on the subject was found, therefore a new complication of obstetrics is presented to the profession. The details of these cases follow:

CASE 1 (Dr. Rubovitz). Age 31, white, married, para i. Admitted to hospital May 5, 1925, 3:30 A.M. after being in labor 2 hours. Pains strong, at 3 minute intervals. Physical examination negative except for obesity. Measurements 23-27-32-20. Blood pressure 120/80. Head floating and after 18 hours of strong pains and bag of waters ruptured showed no attempt of engage. Baby delivered by cervical cesarean section at 9:30 P.M. Ether anesthesia. In delivering placenta moderate traction resulted in inversion of the uterus through the incision in the lower uterine segment. Placenta peeled off but fundus could not be replaced until the incision was enlarged upward. The remainder of the operation was easy. Blood loss estimated 300 c.c. Progress notes show good convalescence. Highest temperature 100.6 on second day. Normal from seventh to thirteenth day. Slight reaction to 100 degrees on getting up. Discharged normal on fifteenth day.

CASE 2.—White, age 17, para i. Last menstruation end of November, 1925. At term August, 1926. Patient in good physical condition except slight edema of ankles; urine negative. Diagnosis LOA, measurements, 21, 25, 30, 18½. Sacrum shows convex curvature transversely and vertical curvature straightened and coccyx

pointing sharply forward. Diagnosis: juxtominor flat rachitic pelvis. Labor began 8 P.M., Aug. 12, 1926. Admitted to hospital 7:05 P.M., Aug. 13, 1926. Had been in labor 23 hours before admission. Baby approximately 6 pounds, and with patient in good physical condition, decided to give further test of labor. Blood pressure 118/80. On admission temperature 98.2°, pulse 96, respirations 18. Urine negative. At the end of 41 hours of unsatisfactory progress with pains of only moderate severity, but exhaustion approaching, cesarean was performed.

Operation: Ether anesthetic. The low operation (laparotrachelotomy) with delivery of the child was uneventful. Pituitrin 1 c.c., administered subcutaneously after the birth of the child. Placenta did not appear at the aperture after ten minutes of expectancy plus uterine massage. Bleeding only moderate. Traction made on cord moderately but no advance. Increased force of traction showed placenta coming through atypically. It was soon noted that the placenta was attached to a mass from which it was separated with difficulty, manually. The first suspicion was that a fibroid had been pulled through the aperture but hand applied directly to the fundus revealed the depression of an inversion. Attempt made to replace the inverted portion impossible because of tight contraction ring. Aperture enlarged by incising upward through the ring made a replacement fairly easy. Uterus packed and drained into the vagina; closed in three layers, bladder replaced, abdomen closed and patient returned to room, in good condition. Convalescence uneventful. Patient left hospital Aug. 25, 1926, with baby.

Dr. J. L. Rems, Cleveland, Ohio, (by invitation) presented a paper entitled, **Gynoplastic Repairs of Old Lacerations Following Child-birth.** (See page 57.)

#### DISCUSSION

DR. J. B. DELEE said his first attempts at secondary perineal repair were made in 1898 in women who had relaxed outlets after delivery. Then he repaired the cervix, and finally a few repairs of cystoceles. Then on the recommendation of Dr. Hirst he tried a few five days after delivery. He quickly gave this up because of the difficulty of getting proper anatomical orientation. He gave up repair of cystoceles for several reasons. In the first place it was impossible to do what he thought was a good anatomic repair. There was always excessive hemorrhage which interfered with thorough work. Unless the tissues of the broad ligament are brought together pretty nearly to the midline and above the fascia between the vagina and the midline, the repair will not be thorough. He still occasionally does a cervical repair. Secondary perineal repairs he does occasionally but not as routine. He instructs his patients to finish their reproductive careers and then come back for a thorough rehabilitation of the genitalia. He admitted that at this time repairs of the perineum do just as well, possibly better than they do in the interval, particularly third degree lacerations.

Another reason for giving up immediate repair work was that quite a number of women had infection, usually mild to be sure, but infections in the pelvis nearly always leave subsequent troubles. Again, the women do not nurse their babies as well if they have had a severe loss of blood.

DR. CAREY CULBERTSON said that it was rather common for patients who have relaxations of the pelvic floor to ask if the conditions cannot be corrected at the time the expected baby is born. As a result of that request he undertook repairs of cystoceles and perineorrhaphies, trachelorrhaphies and even amputation of the cervix, but had come practically to the same conclusion as Dr. DeLee outlined. He does not like to perform a cystocele operation immediately after labor

for the reason that the hemorrhage is profuse and there is difficulty in securing an exact anatomic orientation. Perineorrhaphy is not so difficult and the results are fairly successful. However, repair of the cervix can be done very effectively.

DR. J. P. GREENHILL asked whether Dr. Bubis used local anesthetic in some of the repairs. Repairs of cystoceles and rectoceles and trachelorrhaphy are easily done under local anesthetic.

Twice he performed a high rectocele and cystocele operation immediately after labor. In both of these the operations were more easily done than in the non-pregnant individual. The blood loss was very small. He felt that it was advisable where possible to do these operations under local anesthesia, especially because general anesthesia adds a certain, even though small, risk.

DR. N. S. HEANEY said that the more extensive the need for operative work is the less he is inclined to do it immediately after delivery since he prefers to operate upon extensive cases after involution had gone as far as possible. Occasionally, he might repair a bulging rectocele or do a trachelorrhaphy to repair a tear from a previous delivery. He is also less inclined to allow women to abort spontaneously in recent years since he prefers to inspect the cervix as a possible cause of the abortion and to carry out any necessary repair work on it while the case is still clean and while the tissues are soft and pliable. It would seem to him that it is frequently impossible to tell whether a case needed extensive repair work or not immediately after delivery. It is no infrequent experience to see a case which at the time of delivery looked as though a prolapse were going to be present, yet when this case comes to the office months after delivery the pelvis upon the closest inspection requires no operative work.

DR. J. L. BUBIS, in closing, said in reply to Dr. DeLee that he had done a great many cystocele operations and had never been troubled with excessive hemorrhage. In those cases where there was a free amount of hemorrhage he has always been able to control it. He has had better results with cystocele than with perineorrhaphy operations. These patients, of course, are hospital cases. In the hospital where one has every facility it is almost inexcusable not to examine the cervix as a routine. A bad cervix causes much more trouble than a bad perineum and even a slight nick in the cervix may be a focus of infection. It is not uncommon to find that after a patient has been subjected to numerous x-rays, the cervix has been examined and found to be the focus of infection.

When is a woman through having her last baby? If the obstetrician tells a woman she needs an operation in six months or a year, ninety-nine times out of one hundred she is not going to be operated on unless she is suffering from the effects of this condition. It is almost impossible to get a young mother into the hospital for a repair unless it is causing her trouble. By the time the infection of the cervix causes symptoms, the woman is much sicker than if she had been taken care of immediately.

DR. BUBIS used morphine and scopolamine in the early stages unless there was complete dilatation of the cervix. Some patients have as many as eight doses of scopolamine. At the time of delivery, the patient is put under deep anesthetic, generally nitrous oxide and occasionally ether. He does not use local anesthesia.

In reply to Dr. Heaney, he said that occasionally one is surprised at the condition of the mother after delivery and likewise at the change in six months. Generally, one is surprised more the other way—thinking on delivery that there is no relaxation and having the woman come back in six months or a year with more relaxation than one figured on. It has been his custom for some time to follow the same routine in abortion cases as Dr. Heaney mentioned, cauterizing the cervix or repairing it at the time the uterus is cleaned out.

DR. N. S. HEANEY spoke of his experience with the cervix as a focus of infection. The Staff at the Presbyterian Hospital, Chicago, are pioneers in the field of focal infections so that during the past years a great number of patients have been examined by him with the question in mind as to whether the cervix was the cause of a possible rheumatism, arthritis or neuritis. In not a single case has he been able to demonstrate the cervix as a focus of infection except in acute gonorrheal arthritis. A few patients requiring hysterectomy on account of menorrhagia were operated upon and since leucorrhea was present and the cervix therefore was regarded as a possible focus of infection the cervix in these cases was also removed and relief followed in not a single instance. Though by analogy the cervix might be suspected as a fruitful source of infection with systemic results, yet in his experience no single case has ever yet been proved.

DR. J. L. RUBIN, in answer to Dr. Heaney, said he had one case in mind: A woman of fifty years, always healthy, developed a severe sciatica. She had gone through the whole gamut of teeth, tonsils, sinus examinations, etc. She was three or four years past the menopause. An infected condition of the cervix was found. Within two weeks after an operation on the cervix the sciatica disappeared. Whether that was just a coincidence or not, he did not know, but he has seen similar cases clear up after operation and treatment. He could not see why the cervix was not just as liable to be a source of infection as any other focus.

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Collective Review

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### New Books

BY ROBERT T. FRANK, A.M., M.D., F.A.C.S., NEW YORK CITY

OF GENERAL INTEREST

LEAKE, a pharmacologist and not a physician, has used *Percival's Medical Ethics*<sup>1</sup> as a stalking horse for his thesis which, in a somewhat more kindly spirit, resembles Bernard Shaw's introduction to the *Doctor's Dilemma*, in which that ever young Irishman says, "We make the doctor the judge, and fine him anything from sixpence to several hundred guineas if he decides in our favor."

Leake is far from being the layman which he calls himself. He is, to some degree, qualified, in my opinion, to discuss the subject at issue and shows insight, a modicum of kindness, as well as understanding throughout. He says, "The profession resists efforts to change its present relation to society." He quotes East, who calls the little guide of *Medical Ethics* issued by *The American Medical Association*, "A little guide to propriety issued by *The American Medical Association*, filled with trade-union rules . . ." What Leake really tries to show is that the rules of "Ethics" are little more than rules of etiquette developed in the profession to regulate professional contacts of the members *with each other*. He calls attention to the confusion between ethics and etiquette, which, after all, all members of the profession naturally realize fully as well as he does. However, etiquette is by no means, in my opinion, as negligible an affair as the author considers it, in guiding those whose good sense, probity, and idealism are not sufficient to do without some artificial aids. The author may at times be justified in believing that professional courtesy is confused with professional morality, and, not being in active practice, he may be unaware of how these two apparently dissimilar subjects may imply the same thing in concrete instances. By and large, "knocking" rather than minimizing the faults of colleagues is the rule with a certain type of practitioner. No one ever speaks in behalf of the calumniated physician, while much attention is focused upon the occasional glossing over of the profession's faults. Again much attention is given to the wrongdoings or mistakes, of which occasional ones see the light of day, but the physician who is sued and sometimes mulcted unjustly because of the activities of the shyster lawyer on false or trumped up malpractice charges, is rarely thought of.

According to the author, true idealism is sadly impossible in medical practice under existing conditions of human nature. This is fairly

<sup>1</sup>*Percival's Medical Ethics*. Edited by C. D. Leake. Williams & Wilkins Co., 1927.

true, and yet, in spite of this, a surprising number of physicians, in my opinion stick to the ideal state at great personal sacrifice.

Leake traces the laws governing medical practice from Hammurapi, king of Babylon some 2200 B.C., to the present. He quotes both the pagan and Christian oath of Hippocrates.

*Percival's Medical Ethics* was written because of friction occurring in the Manchester Infirmary. Percival, in 1791, was asked by the trustees of the infirmary to draw up a scheme of professional conduct, which he did during the course of the next three years. This scheme is given in detail and in addition to the oath of Hippocrates, the code of ethics of *The American Medical Association* of 1847 and the principles of medical ethics of *The American Medical Association* of 1903 are included. The introductory essays by the author, delivered at the Harvard Medical School in 1927 at the suggestion of Dr. Harvey Cushing, are delightful, well worth reading, and contain much, as my discussion has attempted to show, of real value to the profession. They should be read in the proper receptive spirit and some of the suggestions, I feel sure, will blossom and bear fruit.

#### GYNECOLOGY

*Gynecology*, by Howard A. Kelly and Collaborators (22 in number), is a landmark in American gynecology.<sup>2</sup> It is a pleasure and a privilege to review this book which, in its way, may be considered the third edition of Kelly's original work on *Operative Gynecology* which appeared in 1901. The second edition in two volume form appeared in 1918. This third one volume edition, although for the first time written with the aid of collaborators, from its charming introduction to the last page, shows the unmistakable hallmark of Howard A. Kelly. Although possibly a trifle uneven in spots, a high standard of excellence prevails throughout. The book mirrors the best that can be found in American gynecology, presented in a readable, convincing form. The group of collaborators gathered by Dr. Kelly, as is readily understood, embrace mainly his immediate associates and such colleagues as came in contact with him at Johns Hopkins, but is by no means limited to these as will be shown if I mention Reuben Peterson, George Gray Ward, Lilian K. P. Farrar, Isidore Rubin, George Gellhorn, and others.

The ever young dean of American gynecology has personally contributed 17 of the 49 chapters so that the book may still be considered predominately his as heretofore. All of these chapters have been brought fully up to date, with perhaps the sole exception of that dealing with leucorrhea, in which the light shed upon the subject by modern researches, dealing with the flora of the vagina, deserves some mention.

The two chapters contributed by Ward on cystocele, prolapse, rectocele, and injury to the pelvic floor, are worth careful study. Anteriorly he favors a somewhat hybrid operation, a technic to which he attaches the syndicated names of Hadra, Goffe, Frank, Alexandroff and Sims. Somewhat to my surprise, I see that posteriorly he still utilizes a technic in which the levatores ani are actually exposed and united. This technic has been abandoned by many operators because

<sup>2</sup>*Gynecology*. By Howard A. Kelly and Collaborators. D. Appleton & Co., New York, 1928.



of the hard, painful perincal shelves resulting from it. The operation for enterocele is very well described.

The Wertheim operation for carcinoma of the cervix is beautifully illustrated, although in the text, as is the trend of modern gynecologists, radio-therapeutic treatment of the cervical canal is, on the whole, preferred.

In tumors of the ovary, dealt with by George H. Gardner and Herbert F. Trout, classification of cystic tumors according to the pathology is confusing. In serous cystadenoma, called by them simply cystadenoma, no mention of their most characteristic feature, namely the ciliation of the gland epithelium, is mentioned. The statement that pseudomucin cysts do not reach the growth proportions of the ponderous serous cysts, is contrary to all the generally accepted clinical data. The attempt to establish a distinct classification on the presence or absence of papillations appears distinctly fallacious as papillary outgrowths are, after all, ascribable to mechanical conditions rather than to any inherent properties of the epithelium. Papillations can be found in the simple follicular retention cysts, in pseudomucin cyst adenomata, as well as in the commonly occurring variety, the serous cystadenomata. Every pathologist will be willing to concede that papillations influence the clinical picture and the prognosis extremely, but I believe that most of them will agree with me that a classification based on the presence or absence of papillary outgrowths is not warranted.

Such chapters as Peruterine Tubal Insufflation by Rubin, Endometriomas by Lewis, Ureteral Stricture by Hunner, Tumors of the Bladder by Burnam and Neill, Protein Therapy by Gellhorn, Radium by Burnam, X-ray by Fricke, Pneumoperitoneal Roentgenography by Peterson, Ultraviolet Radiation by Fricke, Electrothermy by Grant E. Ward, Topics on Psychopathology by Esther Loring Richards, show the tremendous ground covered in this textbook, as well as the wide appeal that it is bound to have throughout the profession.

Few men can hope to look upon as long, active and fruitful a career as Howard A. Kelly. We hope that he will continue to exercise a guiding influence on American, and in fact, on world gynecology for many years to come. This book sums up an entire era of gynecology and is a lasting landmark in medical literature.

Schröder's monograph on the genital cycle of the human female and its disturbances<sup>3</sup> is a most impressive contribution, complete, containing carefully selected material, much personal research which has extended over years, and a detailed search of the literature. The large clinical material which is embodied has been worked over and sifted in a most meticulous fashion. If anything, from the American point of view, the monograph is a trifle too long to be readily read. On the other hand, it is a wonderful mine of information and can be referred to for material and literature alike.

The many microphotographs, particularly of the ovary and endometrium, in a multitude of functional stages, cannot be duplicated in any other book. Fifty pages are devoted to the cycle of the lower animals. Schröder, as is well known, has elaborated and fortified the theory of menstrual endometrial desquamation by his many continued and personal researches. He submits the physiology of the female

<sup>3</sup>*Handbuch der Gynaekologie.* Herausgegeben von Dr. W. Stoeckel. Erster Band. Zweite Hälfte. Der mensuelle Genitalzyklus des Weibes und seine Störungen, von Dr. R. Schröder. J. F. Bergmann, München, 1928.

sex hormone to a detailed analysis. In addition to the introductory, anatomic and physiologic portion, much careful attention has been devoted to the clinical changes which occur during both the normal cycle and in disease. He emphasizes, as he always has, the abnormal persistence of the ripening follicle and the irregular hemorrhages resulting therefrom, due to a stationary hyperplasia which he calls metropathia hemorrhagica. Endometritis, endometriosis, as well as general disturbances accompanying menstruation, are discussed. The book is a monument of accuracy based on personal research, both laboratory and clinical, and can be used as a valuable mine of information.

In the same series, Engelmann has described sterility and sterilization<sup>4</sup> in the course of 279 pages. The subject is treated from every aspect most thoroughly and detailedly. Particular attention is paid to insufflation, salpingography, the various indications for stimulating doses of x-ray, after the functional and organic causes of sterility have been dealt with. The concluding portion of this monograph deals with the causes justifying sterilization and the methods employed.

The second portion of this installment, which in all represents the third volume, is the importance of constitution in gynecology by A. Mayer, a most complete monograph of 575 pages. First he takes up the difference between man and woman, then the special female characters. The changes due to marriage and pregnancy are discussed; the comparative duration of life in women and men and their psychic differences. Under pathology of constitution, the somatic types are first described, then the marked deviations, such as infantilism, in which he takes up face, hands, teeth, breasts, vulva, hair, general build, and the internal genitals themselves are dealt with. Among other conditions are asthenia, obesity, gigantism, and nanism. Tonus anomalies, intersexual and hypersexual types are next discussed. The influence of constitution on menstruation is an important and interesting phase; the early or late appearance of the menses, dysmenorrhea, sterility, disturbances of pregnancy, all come under this main heading. Next the sex of offsprings, twinning, and other fetal anomalies are mentioned. Intercurrent conditions as fluor, tuberculosis, carcinoma, the resistance to operation are discussed from the point of view of constitution. This, like Schröder's contribution, must be considered a most valuable addition to the world's literature. The sole criticism that I have to make is, that both of these monographs err on the side of too great a completeness, verging on prolixity, which does not distract from their value as reference handbooks, but will keep the average reader from perusing them from cover to cover.

The fourth edition of Faure's well-known treatise of gynecology,<sup>5</sup> a large two volume affair, has just appeared. Faure today is the dean of French gynecologists and holds one of the few chairs in France strictly reserved for this specialty. The anatomic descriptions, as heretofore, are very good, including the illustrations. The chapters dealing with physiology are by no means modern or up to date. This applies especially to the description of the details of menstruation. As a direct result of this somewhat archaic physiology, the treatment of

<sup>4</sup>Handbuch der Gynäkologie. J. Velt-W. Stoeckel. Dritter Band. Sterilität und Sterilisation. Bedeutung der Konstitution für die Frauenheilkunde. Bearbeitet von F. Engelmann und A. Mayer. J. F. Bergmann, München, 1927.

<sup>5</sup>Traité de Gynecologie Medico-Chirurgicale. Quatrième édition, par J. L. Faure et A. Siredey. Gaston Doin et Cie, Paris, 1928.

functional diseases is likewise not modern. After all, to speak of "asthenopie d'origine utérine" based on a reference to Morse of 1887 (*New York Medical Journal*, 1887) is hardly excusable. Instead of references to Deuteronomy and Leviticus in regard to leucorrhea, the average reader would prefer some description of the degrees of contamination (Reinheitsgrade). The description of operations for prolapse are not complete from our point of view.

The authors feature lipiodol for the determination of tubal patency. The descriptions of medical treatment are detailed. Most conservative technics of operations are gone into quite fully and are illustrated in a striking fashion. The French literature is considered in great detail so that this volume should be an excellent source to find references to the French literature. On the whole the treatise must be considered a very well balanced gynecologic textbook. Operative indications are not stressed to the exclusion of conservative measures.

*Radium in Gynecology* by the late John G. Clark together with Charles C. Norris and Dr. G. Failla<sup>6</sup> covers the entire subject in a manner designed to meet the requirements of the medical man and especially of the gynecologist in order to help him select the proper cases for treatment.

Although the article by Failla on physics is 100 pages in length, very interesting and clearly written, it will hardly be sufficiently detailed to act as a guide to the trained roentgenologist, but is an extremely lucid description.

The historic introduction to the subject is pleasant and informative, and shows why radium has gone down to \$70.00 a mg. with ultimate prospect of eventually reaching one-half of this price, as well as the destruction of the American radium producing companies. However, radium will always remain expensive as it is present only in 1 to 2,800,000 parts of uranium.

When used for castration by application in the uterus, 1200 mg. hours are required to act on the ovaries. This amount of application, and this I consider a serious defect of radium versus x-ray castration, will always produce a persistent leucorrhea. The authors favor biopsy for diagnosis and, in spite of theoretic danger of exploratory curettage, likewise advocate this diagnostic measure in cases suspected of corpus carcinoma.

The authors present no statistics of their own on carcinoma of the vulva and vagina. In carcinoma of the cervix, although immature types respond more readily by preliminary healing to radium, the local response being 76 per cent in comparison to 51 per cent in more mature types, the end-results in both groups are the same. Clark found that in Group 1, in which carcinoma of the cervix is limited to the uterus, radium alone cured 28.5 per cent, while radium combined with high trachelectomy by means of the cautery knife, cured 83 per cent. I notice with approval that the authors advocate preliminary curettage in all supposedly benign hemorrhages from the uterus before using radium. The sole criticism I have to make of the book is its extremely impersonal method of presentation. I would have preferred to have heard more of the personal experiences of both of the authors because of their extensive study of the subject.

Three more installments of Halban and Seitz's *Biology and Path-*

<sup>6</sup>*Radium in Gynecology*. By John G. Clark and Charles C. Norris. J. B. Lippincott Co., Philadelphia, 1928.

*ology of Women* have appeared. Installments 40 and 42 deal with Forensic Gynecology by Reuter of Graz. The German and Austrian laws are the ones considered. Consequently the American gynecologists will not derive full benefit from these monographs. However, the subject matter dealt with is, after all, applicable to the laws of any nation, with some changes. Every aspect of legal medicine in reference to gynecology is discussed in detail. Such subjects as the legal responsibility of physicians, the physician as an expert witness, are of general interest. Of special importance to gynecologists is the diagnosis of virginity and of rape, the legal indications for sterilization, the determination of stillbirth or murder of the newborn, the diagnosis of antecedent abortion, and other like subjects.

Installment 41 contains the subject of the relation of the nervous system to the genitals by J. Novak of Vienna. A good anatomic description, well illustrated, is introductory. Diseases due to menstruation and pregnancy are discussed. The author finds no increase in peripheral irritability in eclampsia. Encephalitis and pregnancy, chorea and pregnancy form interesting reading. The trauma of labor on the peripheral nerves is important. Finally, the injury to the fetal brain is carefully gone into, with illustrations. The second portion of this installment deals with the physiology and pathology of puberty in the female by Neurath of Vienna. Of interest are especially the tumors of the pineal and adrenal glands, producing premature puberty.

Cotte, successor to Polloson of Lyons,<sup>8</sup> after remarking that operative technic is stabilized and standardized but that therapeutic problems continue to require elucidation, has produced this huge and massive compilation covering every aspect of the functional disturbances of the female genital tract, including physiology, clinical manifestations, and therapeutics. The treatment, while impartial and thorough throughout, lacks originality and the personal touch. An immense amount of literature is incorporated, especially from French sources, but because of the lack of an authors' index, is not readily accessible to the research student. All the newer acquirements, such as the contamination degree of fluor, insufflation, lipiodol injections, and operations for sterility, are discussed in full.

Crossen's *Gynecology for Nurses*<sup>9</sup> is a concise, beautifully gotten up textbook of less than 300 pages. It is profusely illustrated from many sources. The text is nice and simple, and yet detailed. In succession the anatomy and physiology of the genital tract, gynecologic diseases, examination, treatment, both nonoperative and operative, and preparation of supplies are gone into. The entire book is very adequate, readable, and good.

Menopause and its disturbances is dealt with by Zacherl.<sup>10</sup> He discusses the physiology and pathology of the onset of the climacterium, and attempts to point the way to recognize menopause symptoms and to weed out other similar symptoms arising from more serious pathologic disturbances, such as myoma and carcinoma. Only too often serious pathologic conditions mask themselves as climacteric disturbances, to the danger and detriment of the patient. This monograph is timely.

<sup>8</sup>*Biologie und Pathologie des Weibes*. J. Halban und L. Seltz Lieferungen 40, 41, 42. Urban & Schwarzenberg, Berlin, 1927.

<sup>9</sup>*Troubles Fonctionnels de L'Appareil Génital de la Femme*. Par G. Cotte. Masson et Cie, Paris, 1928.

<sup>10</sup>*Gynecology for Nurses*. By H. S. Crossen. C. V. Mosby Co., St. Louis, 1927.

<sup>11</sup>*Die Wechseljahre der Frau*. Von H. Zacherl. Julius Springer, Wien, 1928.

Tottenham's *Aids to Gynaecology*<sup>11</sup> has reached its seventh edition. This book evidently fulfills a want as its republication indicates.

#### OBSTETRICS

Séjourné's monograph on *Mitral Stenosis and Pregnancy*<sup>12</sup> emphasizes the fact that radiologic examination is necessary in order to determine the size of the left auricle which must be watched. If there is dilatation, interruption of pregnancy is indicated. He warns against using ether in emptying the uterus. Pregnancy should be forbidden in every case of mitral stenosis in which there has been an attack of edema of the lungs. About one-half of the cases are stationary and these cases may be allowed to go to term. The monograph is lavishly illustrated with roentgenograms.

Grosser, whose work on placentation has been classic for many years, has written, as part of the *Deutsche Frauenheilkunde* a general work on the development of the fetus, membranes and placenta of the human species and mammals.<sup>13</sup> Considerable space is devoted to the comparative study of placentation in different species, including the very useful description of laboratory animals. The main subdivisions of the book are on progenesis, dealing with the ovum, the sperma, and fecundation; blastogenesis which deals with the early divisions of the ovum; and placentation. Seventy-five pages are devoted to the comparative aspects of this important question, the rest to the human being. The book is well illustrated, complete, and contains good references to the literature. It is a most authoritative exposition of the subject, and of particular use to medical men as a source of reference.

Vignes and Jean, with the collaboration of Robin, have issued *L'Année Obstétricale* covering 1925.<sup>14</sup> It is a pity that so much time intervenes between the assembly and appearance of this valuable summary and digest of obstetric activities. The French editors should keep in mind and emulate the promptitude of our American year books which are in the hands of their readers only a few months after the year is completed.

The authors have shown their well-known care, reliability, and exactitude. Normal pregnancy, especially the features of diagnosis and the changes in the individual organs, are taken up. Under pathologic pregnancy, ectopic, hemorrhage during pregnancy, pernicious anemia, the toxemias and intercurrent diseases are dealt with. Abortion, tumors, labor, therapeutics are among the subjects covered. The allied subject of puericulture, the pathology of the newborn, legal obstetrics, are included. Under the heading of researches, the function of the placenta and of the pancreas during pregnancy, the Wassermann reaction as affected by pregnancy, and in pregnancy, epidemic abortion, carcinoma in pregnancy, are a few of the subjects discussed. References to the literature throughout are abundant, international and accurate.

<sup>11</sup>*Aid to Gynaecology*. By R. E. Tottenham. Ed. 7. Wm. Wood & Co., New York, 1928.

<sup>12</sup>*Le Retrecissement Mitral dans ses Rapports avec L'Etat Puerperal*. Par J. Séjourné. Gaston Doin & Cie, Paris, 1923.

<sup>13</sup>*Frühentwicklung Eihautbildung und Placentation des Menschen und der Säugetiere*. Von Otto Grosser. *Deutsche Frauenheilkunde*. Fünfter Band. J. F. Bergmann, München, 1927.

<sup>14</sup>*L'Année Obstétricale*. Travaux de 1925 et Questions Obstétricales d'Actualité. II. Vignes et B. Jean avec la collaboration de V. Robin. Masson et Cie, 1927.

That most prolific author, L. Fraenkel, has now written a short treatise on *Social Obstetrics and Gynecology*<sup>13</sup> designed for the guidance of physicians employed by the government in schools, institutions, hospitals, industrial lodges, legal, police, athletics, children, women, and other specialties. The scope of this small monograph is huge. It begins with the neonatus, blenorrhea of the eyes, takes up vulvovaginitis of children, life during puberty, bad habits formed in youth, such as the overloading of the bladder and the rectum. He deals with modern woman's clothes, the lightness of which he considers admirable, weighing 1 pound against 6 pounds for men. He takes up such diverse subjects as sports, injuries, including the determination of virginity, sex, pregnancy, and rape. Marriage and its duties are discussed. Work, fertility, and sterility, the guidance during pregnancy, instruction in gynecology and obstetrics, etc., are among the topics dealt with in a most brief and yet understandable fashion. This book would be worth translating.

This *Medical Report for the year 1926 of the Glasgow Royal Maternity and Women's Hospital*<sup>14</sup> is the first formal report issued by this hospital. Within its walls 3650 cases were treated during the year, with 92 maternal deaths. The entire report is in the form of short, comprehensive tables dealing with every phase of obstetric activities. In addition, 3594 cases were attended in their homes, with only one maternal death.

*The Toxemias of Pregnancy. Clinical and Biochemical Study* by Cruickshank, Hewitt and Couper, is issued under the aegis of the Medical Research Council of 1927.<sup>15</sup> It is based on 200 cases of toxemia of the second half of pregnancy, and 42 normal pregnant women. This report like the preceding also comes from the Glasgow Royal Maternity Hospital. The material is divided into albuminurias, pre-eclamptic toxemias, nephritic toxemias, and eclampsias. This short monograph goes into a very detailed analysis and has elaborate charts in which all the symptoms are discussed in detail. Careful examinations of the blood and urine are likewise reported. No evidence favoring either an endocrine or parasitic origin of toxemia has been found. A number of possible sources for the toxic factor must be considered including the fetus, placenta, and disturbances of maternal metabolism. The monograph concludes with a careful analysis of the cases in the form of case histories.

*Childbirth* by the late Dr. William George Lee, of Chicago,<sup>16</sup> is a short, handsomely gotten up book. There is a philosophic introduction, and throughout, the subject is rather discursively and generally presented with few but excellent line drawings as illustrations. The method of treatment, which is almost that of an essayist, makes the reading of this volume easy but leaves the reader with somewhat hazy ideas. Its perusal should be of particular interest to well-instructed laymen or to the medical students just beginning their obstetric work.

<sup>13</sup>*Soziale Geburtshilfe und Gynaekologie.* Von L. Fraenkel. Urban & Schwarzenberg, Berlin, 1928.

<sup>14</sup>*Medical Report for the year 1926. Glasgow Royal Maternity and Women's Hospital* J. N. Cruickshank, M.D. William Hodge & Co., Ltd., Glasgow and Edinburgh, 1927.

<sup>15</sup>*The Toxemias of Pregnancy. A Clinical and Biochemical Study*, by J. N. Cruickshank, J. Hewitt and K. L. Couper. His Majesty's Stationery Office, London, 1927.

<sup>16</sup>*Childbirth.* By Wm. G. Lee. The University of Chicago Press, Chicago, 1928.

Miltner has undertaken the sixteenth edition of B. S. Schultze's *Textbook of Midwifery*,<sup>19</sup> the book being designed for midwives rather than for physicians. The first edition of this classic appeared in 1860, the fifteenth edition in 1914. Döderlein has written the introduction. The expansion of the volume is warranted by the fact that in Bavaria the course for midwives has been extended from five to twelve months. The text is clear, concise, and well arranged. Would that our midwives were subjected to a similar intensive course of training.

Burckhard,<sup>20</sup> under the guise of an *Obstetric and Gynecologic Therapeutics*, has produced an alphabetically arranged list of German chemical products, interspersed here and there with descriptions of diseases and interventions. The descriptions of diseases and methods of treatment are far from being poor but the drug list resembles that put out by the ordinary pharmaceutical advertiser.

Hammond's *Physiology of Reproduction in the Cow*<sup>21</sup> was written in 1922 but a short addendum brings the literature up to date. The studies were undertaken mainly to settle practical breeding questions and for milk improvement, but the observations are so accurate that they are important to the physiologist and medical man. In order to test the actual time and duration of estrus, he adopted the method of Ancel and Bouin of using a vasectomized bull. Observations were made on heat, impregnation, the cycle, pregnancy, changes in the udder, and sterility. The study may be considered a valuable *morphologic* contribution and the literature contained is also of use. The latest physiology is not incorporated in the text or in the addendum.

#### SURGERY AND PUBLIC HEALTH

The third edition of Horsley's *Operative Surgery*<sup>22</sup> is a very well-balanced, instructive textbook, covering all phases of surgery adequately, but particularly interesting along certain lines which the author has always emphasized. Chief among these are the biologic versus the mechanic phases of surgery. After all, this point of view will prevent a surgeon from recklessly following fads which have an entirely wrong theoretic basis of which I may instance the metal bone plates so popular a few years ago. Among the numerous newer surgical advances treated of in the book, are a chapter on cicatricial contractions, the Blair-Bell lead treatment of cancer, the numerous new technics for gastric resection, intestinal anastomosis without clamps, Cutlers' operation on the heart, and Sauerbruch's thoracoplasty. Such a purely cosmetic operation as face lifting, is discussed in considerable detail. Only a very short description of peri-arterial sympathectomy is given. Many new and excellent illustrations have been added to the book which will be found most useful for both the student and the practicing surgeon because not only are the elements and general principles given, but Dr. Horsley's many technical innovations are embodied in the text.

Volume VII of the *Medical Department of the United States Army in the World War*<sup>23</sup> has been edited by Col. William N. Bispham, M.C.

<sup>19</sup>Lehrbuch der Hebammenkunst. Von B. S. Schultze. 16 Auflage. Neu bearbeitet von Dr. v. Miltner. Wilhelm Engelmann, Leipzig, 1928.

<sup>20</sup>Geburtshilfliche und gynäkologische Therapie. Von Dr. Georg Burckhard. Urban & Schwarzenberg, Berlin, 1928.

<sup>21</sup>The Physiology of Reproduction in the Cow. By J. Hammond. The University Press, Cambridge, 1927.

<sup>22</sup>Operative Surgery. By J. S. Horsley. Ed. 3. C. V. Mosby Co., St. Louis, 1928.

<sup>23</sup>The Medical Department of the United States Army in the World War. Vol. VII. Training. By Col. Wm. N. Bispham. Prepared under the direction of Maj. Gen. M. W. Ireland. U. S. Government Printing Office, Washington, 1927.

It deals with the training of medical, dental, sanitary, and veterinary officers as well as the nurses and medical corps, both in the United States and in the A.E.F.

The various medical officers' training camps, the training in posts, mobilization, and other camps, are taken up in detail. Over 150 pages are devoted to Camp Greenleaf, Georgia, with many illustrations. In summary Fort Riley, Fort Benjamin Harrison, Fort Des Moines are referred to. The special schools, including the Army Medical School, Washington, are discussed. In the army medical school routine medico-military education had been given with attention to hygiene, laboratory work, x-ray, orthopedies and research. Suddenly these activities had to be tremendously expanded. This was done by the aid of professional schools opened at various institutions and universities, of which I instance merely a few such as Yale, Cornell, Washington, Harvard, University Hospital Philadelphia, Rockefeller Institute, New York, etc., etc. A school of nursing is likewise described, as well as the activities necessary to drill and teach dentists, veterinarians and sanitary units.

In the A.E.F. the Army Sanitary School of Longres is described. An appendix of over 500 pages is an *omnium gatherum* which includes subjects from ambrine to x-ray. This volume of the series, of which others have been reviewed, makes interesting reading, is informative and will prove of use in keeping the medical corps active and alive.

Volume IX is a composite description of the communicable and other diseases<sup>24</sup> occurring during the World War, in the American Army, both in this country and abroad. A number of authors have described the various phases. Typhoid fever, which in the Spanish American War attacked 114 out of every 1000, in the World War afflicted our army only 0.37 to the 1000. Influenza, on the other hand, caused a tremendous morbidity rate. It was impossible always to differentiate influenza, bronchitis, broncho- and lobar-pneumonia, to which may be credited 80 per cent of the total deaths from diseases occurring during the war.

Volume XIII deals with the important subject of physical reconstruction and vocation by Major A. G. Crane,<sup>25</sup> the second and smaller portion of the volume being devoted to the Army Nurse Corps. A voluminous appendix concludes this thick tome.

The report by Cadenat and Patel on *Drainage in Abdominal Surgery*<sup>26</sup> was made to the 36th French Surgical Congress. The analysts favor no drainage where the lesion can be eradicated and the peritoneum left or restored to intact condition. They advocate drainage in bad pelvic cases, drainage down to the gall bladder stump, and to the stump of a perforated appendix in which the region cannot be entirely peritonealized, and in regions necessitating anastomosis of the descending colon.

<sup>24</sup>The Medical Department of the United States Army in the World War. Vol. IX. Communicable and Other Diseases. By Lieut. Col. J. F. Siler. Prepared under the direction of Maj. Gen. M. W. Ireland. U. S. Government Printing Office, Washington, 1927.

<sup>25</sup>The Medical Department of the United States Army in the World War. Vol. XIII. Part I. Physical Reconstruction and Vocational Education. By Maj. A. G. Crane. Part II, The Army Nurse Corps. By J. C. Stimson.

<sup>26</sup>Le Drainage en Chirurgie Abdominale. By F. M. Cadenat and M. Patel. Gaston Doin & Cie, Paris, 1928.



*The Annual Report of the Surgeon General of the United States for 1927*,<sup>27</sup> as usual, contains a wealth of information, but does not lend itself to review. Such diverse subjects as the incidence rate for colds, leprosy investigations, malaria, and nutritional diseases will be found in successive paragraphs.

Another important federal report is the Eleventh Annual Report containing the birth, stillbirth and infant mortality statistics for 1925.<sup>28</sup>

The eighth series of *Methods and Problems of Medical Education* issued by the Rockefeller Foundation<sup>29</sup> is about equally divided between European and American Institutions. The internal medical clinics of France, Germany, England, Holland, Canada, and the United States are discussed. Besides that, there are descriptions of surgical clinics in various countries. Heart clinics are also described, and the new obstetric hospital and residents' quarters, University College Hospital, London, is reported. Teaching gynecology, University and Bellevue Hospital Medical School, New York, is included in this volume which contains short descriptions of these various departments.

#### INTERNAL SECRETIONS AND BIOLOGY

The fourth installment of the third volume of the *Handbuch der Inneren Sekretion* by Hirsch<sup>30</sup> contains the completion of Eggenberger's Thyroid, Goiter and Cretinism. Of the 4,000,000 Swiss inhabitants, 30,000 have had goiter operations, but with the expansion of prophylactic measures, this average is rapidly diminishing. A full description of cretinism is given.

Peritz discusses the parathyroid. Without too close scrutiny, he places a number of diseases under the heading of constitutional spasmophilia and angiospastic dystrophy. He emphasizes nervous hyperirritability and attempts to illustrate a characteristic mouth, and especially discusses cold hands and feet. The theories and therapy of tetany are fully discussed. He is evidently not able to utilize Collip's parathormone because it is not obtainable abroad.

Leschke deals with the diseases of the vegetative nervous system in a most interesting and instructive fashion, giving the applicability of this research to every phase of endocrine disturbance. He goes with great thoroughness into all the reactions, both drug and others, for the determination of changes in the vegetative system, and gives a detailed description of methods of examination, types encountered, etc. Among the diseases dealt with are diabetes insipidus and mellitus, edema, dystrophies, both accompanied by adiposity and atrophy of fat, sleeplessness and sleeping diseases, chorea and myopathies. The installment concludes with a description by Cimbali of psychoses and neuroses from the endocrine aspect. This series is proving to be extremely important and authoritative.

<sup>27</sup>Annual Report of the Surgeon General of the Public Health Service of the United States for the Fiscal Year 1927. United States Government Printing Office, Washington, 1927.

<sup>28</sup>Birth, Stillbirth, and Infant Mortality Statistics for the Birth Registration Area of the United States, 1925. Eleventh Annual Report. Part I. United States Government Printing Office, Washington, 1927.

<sup>29</sup>Methods and Problems of Medical Education (Eighth Series) Division of Medical Education. The Rockefeller Foundation, New York, 1927.

<sup>30</sup>Handbuch der Inneren Sekretion. Dr. Max Hirsch. III Band, Lieferung 4. Curt Kabitzsch, Leipzig.

Hogben's *Comparative Physiology of Internal Secretion*<sup>31</sup> is an excellent, well written, extremely conservative, and most judicial presentation. He has confined his discussion to certain phases of the subject and treated these thoroughly without prejudgment. In discussing adrenalin and neuromuscular coordination, he has entirely thrown overboard the tonus theory. On the other hand, he appears to accord considerable value to the effect of the pituitary posterior lobe secretion on vasomotor regulation. The chapter on the ductless glands in the developmental process is extremely interesting. Emphasis is placed on the possible fallacies in the interpretation of metamorphosis as affected by glandular feeding.

Somewhat to my surprise, Hogben appears to accept the tenuous hypothesis of Dixon and Marshall on the effect of ovarian secretion in promoting posterior pituitary secretion which, in turn, is supposed to have a specific excitatory action on the uterus. According to this hypothesis, the case in which I was forced to remove the last remaining ovary during the fifth month of gestation should have gone far overtime if spontaneous labor were to occur at all. Instead of this, the patient had a normal, uncomplicated labor, setting in exactly on the predicted date.

It is rather impossible to agree with Hogben when he quotes and accepts the statement of Jeoffrey Smith that the secretion of the ovary or of the testis is not an established fact. Hogben should keep in mind that Loewe and I simultaneously demonstrated by specific methods the presence of the ovarian secretion in the circulating blood.

*The Rate of Living* by Raymond Pearl<sup>32</sup> embodies the expanded lectures given at University College, London, during 1927. The author says that biostatistics is the sign, symbol, and indeed in some respects, the very essence of a separate science, the biology of groups. The volume is based on eight years of study of a carefully controlled life of the fruit fly (*drosophila melanogaster*). The author deals with mortality in the main, but in order to make the reader understand, he enters into the technic and then discusses density, duration and inheritance of longevity. The rate of life depends on the rate of living. This very readable exposition of a rather difficult subject is well worth while.

Crew, in his *Genetics of Sexuality in Animals*,<sup>33</sup> handles an extremely difficult subject. As he says, until now this subject has dealt mainly with "the significance of ratios between classes of related individuals which appear in successive generations of an experiment starting with two types that differ from another in respect of one or more heritable characters." Crew likewise says, "I dread lest in my presentation I may chill the interest in my subject that I would awaken in the reader." As far as I am concerned, he came near doing so, because I had to start the reading of this book three times before I could become sufficiently interested to continue its perusal, but was then really repaid for the trouble. Perhaps the fault lies in the fact that genetics has developed a language of its own, a terminology and phraseology as distinct from the medical as that used by a lawyer. In the next

<sup>31</sup>The *Comparative Physiology of Internal Secretion*. By Lancelot T. Hogben, M.A. Macmillan Co., New York, 1927.

<sup>32</sup>The *Rate of Living*. By Raymond Pearl. Alfred A. Knopf, 1928.

<sup>33</sup>The *Genetics of Sexuality in Animals*. By F. A. E. Crew. The Macmillan Co., New York, 1927.

edition I would suggest a readily accessible glossary to help the reader over these first stumblingblocks.

Sex in the higher animals is usually predetermined at the time of fertilization. The author deals with sex determination, parthenogenesis, sex-linked inheritance. For sex reversal there must be a switchover from one type of metabolism to another. The sex ratio is likewise discussed. The presentation is clearcut, concise, but seems very difficult reading for the average medical man.

In my search for a usable *Zoology* for both myself and medical students, I have come across the one by Kerr of Glasgow, published a number of years ago.<sup>34</sup> Its comparatively short compass of nearly 500 pages, in spite of profuse illustrations, its clearcut description of morphology, makes it useful. Any medical man who keeps up with biologic literature is constantly obliged to work up the lower forms which are used in experimental laboratories. For this purpose Kerr's book is very desirable. Lack of space has necessitated the omission of the higher vertebrates. Other volumes readily accessible, can overcome this deficiency. On the whole, I have found the book of great use.

*The Requirements in Calcium for Human Beings and Animals* by Oscar Loew<sup>35</sup> is a short monograph appearing in its fourth edition. Only the lowest algi can do without calcium, which is necessary for the heartbeat, the blood coagulation, and other vital functions. Calcium, contrary to the usually accepted views, is even more important for the soft parts than for the bones. Magnesium in excess is antagonistic to calcium. The requirements of the mother and child for calcium are discussed in detail. The author administers calcium in form of kalzan, a calcium double salt lactate of calcium and sodium. Calcium also plays an important part in animal breeding.

#### MEDICINE

*Pathological Physiology of Internal Diseases* represents the third edition of Hewlitt's textbook, revised in memoriam by nine of his colleagues.<sup>36</sup> The general form of the previous editions has been more or less kept up. Hewlitt was primarily a physiologist who drifted into medicine and who, therefore, was both desirous and well fitted to bring the clinic and laboratory together. The main object of the book has been and still is, to show the changes in function due to internal diseases. The various systems have been covered seriatim. To the heart and blood vessels 140 pages are devoted. One-half of this space is given to digestion and absorption. Metabolism, both nasal and other, is taken up. Next the diseases of the liver and pancreas are dealt with, followed by disturbances of the kidney, disturbances of heat regulation, fever, with two shorter chapters dealing with the endocrine and nervous diseases. Each chapter is concluded by a good, detailed, working bibliography. The volume is so arranged as to make reference to it quick and easy. A tremendous amount of information is contained within its pages in concise, didactic form.

The twentieth edition of a *Textbook of Practical Therapeutics* by

<sup>34</sup>*Zoology for Medical Students.* By J. Graham Kerr. Macmillan & Co. Ltd., London, 1921.

<sup>35</sup>*Der Kalkbedarf von Mensch und Tier. Zur chemischen Physiologie des Kalkes.* Oscar Loew. Ärztliche Rundschau, Otto Gmelin, München, 1927.

<sup>36</sup>*Pathological Physiology of Internal Diseases. Functional Pathology.* By A. W. Hewlitt. Revised in Memoriam by his Colleagues under the Editorial Supervision of George De Forest Barnett. D. Appleton and Co., New York.

<sup>37</sup>*A Textbook of Practical Therapeutics.* By Hobart Amory Hare. Ed. 20. Lea & Febiger, Philadelphia, 1927.

Hobart Amory Hare<sup>7</sup> has appeared and, like each preceding edition, has been really thoroughly revised and kept up-to-date. Early in my medical career I acquired the habit of looking up prescriptions, short descriptions of diseases, methods of treatment in this epitome, compend and textbook combined, and this habit has persisted, because Hare's treatise is unique for its short, clear, and specific instructions and descriptions. Probably some of its usefulness is due to the fact that the author has never hesitated to obtain the collaboration of leaders in special topics. In this edition this applies particularly to the eye, to the treatment of puerperal diseases and abortion, transfusion, artificial pneumothorax, diseases of the skin and syphilis. Even such recent topics as the antiscarlatinal and antimeasle serum are discussed. The division into drugs, other remedial measures, feeding, diseases, and very detailed indices has been kept up. I know of no purer mine of information than these more than 1000 pages embody.

Another book by Hobart Amory Hare is the *Use of Symptoms in the Diagnosis of Disease*.<sup>8</sup> It has already reached its ninth edition. The aim of this volume is the recognition of symptoms leading to diagnosis, or, conversely, the upbuilding of a diagnosis by grouping of symptoms. This volume likewise is concise, to the point and most instructive. The arrangement is partly regional (as of the face and body), partly symptomatic (as convulsions, coma, pain). An excellent sample of the completeness of this short volume is furnished by the subject of rashes, for example, in which every conceivable etiologic factor is entered into with great detail.

Under the heading, *Collected Studies and Reports, University of Iowa Studies in Medicine*,<sup>9</sup> are gathered varia, reprinted from medical journals. Many topics are dealt with, mainly in physiology, cardiology, pharmacology, and neurology. The collection contains 40 articles by numerous authors.

The American Medical Association of Vienna has its own journal called *Ars Medici* of which volume v, number 1 of the year 1927<sup>10</sup> has been submitted for review. In it will be found a review of some German and Austrian literature which is well arranged, well extracted, but far from complete. It also contains the local Viennese medical notes and gossip. This journal should appeal to the Americans abroad as well as to Americans who have spent time in Vienna and are interested in its local happenings. As a review journal its scope is too small to be inclusive.

#### MISCELLANEOUS

The fourteenth edition of Delafield and Prudden's *Textbook of Pathology*, revised by Francis Carter Wood<sup>11</sup> appears as a well tried and old friend. Although keeping up the format, arrangement, and general appearance which has endeared it to its readers over so many years, this edition takes cognizance of all the newer developments in pathology, including the keeping of bibliographic references up-to-date. Therefore, the reader will find vitamins and hormones discussed, changes in the description of liver and gall bladder, as well as

<sup>7</sup>The Use of Symptoms in the Diagnosis of Disease. By Hobart Amory Hare. Ed. 9. Lea & Febiger, Philadelphia, 1928.

<sup>8</sup>University of Iowa Studies in Medicine. Collected Studies and Reports. Vol. III. No. 1. The University, Iowa City, Iowa, 1927.

<sup>9</sup>Ars Medici. The Journal of the American Medical Ass'n of Vienna. Volume V, Number 1, Vienna, January, 1927.

<sup>11</sup>A Textbook of Pathology. By F. Delafield and T. M. Prudden. Ed. 14. Revised by F. C. Wood. Wm. Wood & Co., New York, 1927.

the pancreas and lungs. In order not to increase the size of the volume unduly, the editor has deleted the chapter on lesions following poisoning.

The third volume of the *Ergebnisse der medizinischen Strahlenforschung*<sup>42</sup> has just appeared, covering a huge field as will be seen from this partial résumé of its contents. The roentgen diagnosis of the nose and accessory sinuses (Steurer); of the ears (Steurer); of acoustic tumors (Schüller); of fractures of the petrosal bone (Schüller) deal with the head. Brauer and Lorey cover x-ray of the bronchi by means of contrast media; Teschendorf of the esophagus; Dillon, of unilateral persistent elevation of the diaphragm; Fleischner, tuberculosis of the intestine. Appendicular x-ray is taken by Gottheiner, while d'Amato has gone into the contrast filling of the gall bladder by Graham and Cole's method. Stern treats of lung echinococcus; Schinz and Slotopolsky give a most interesting exposition of the radio biology of the skin with most instructive microscopic pictures of the changes that the skin undergoes. Lippman discusses light and metabolism while Schempp treats of adenoids and nasal pharyngeal polypi. Of particular interest to the gynecologist is the diathermy treatment in gynecology by Schoenholz, who goes into the theory and technic in great detail. Throughout, the lavish and beautiful illustrations mentioned in the previous volumes, are in evidence in this number. The text contains 613 figures.

Under the heading of *Archives Roumaines de Pathologie Expérimentale et de Microbiologie*, a new journal has been ushered in under the direction of J. Cantacuzène.<sup>43</sup> Volume I, number 1, of January, 1928, has been submitted for review. The journal is a quarterly. The editor originally studied in the Pasteur Institute for many years and has gathered a group of workers around him in Roumania during the last twenty-five years. The format, typography, and illustrations of this journal are good, verging on the lavish.

The first article by the editor himself, deals with the immunity reactions in invertebrates. The animal used in this investigation is sipunculus nodus. This paper contains 24 gorgeously colored plates.

The next article by Combiesco deals with the study of anthrax infection, the bacteria being placed in capillary tubes in the skin and peritoneum. The organisms rapidly acquire resistance against the tissue juices.

Ciuca and Alexa find that stovarsol cannot replace quinine in the routine treatment of malaria.

Parhon, Marza and Cahane have communicated an elaborate investigation on the water contents of organs and tissues under the influence of the nervous and endocrine system. The central end of a cut nerve, as well as denervated muscle, contains more water than the normal. There are several other articles in this new journal, to which we wish success.

The last number of *International Clinics*<sup>44</sup> deals mainly with travel clinics, many of which are informative. The radium home at Stockholm is interestingly described. Over 5000 patients a year are treated. The

<sup>42</sup>*Ergebnisse der medizinischen Strahlenforschung (Roentgendiagnostik, Roentgen-, Radium- und Lichttherapie)*. H. Holfelder, H. Holthausen, O. Jungling, H. Martius. Band III. Georg Thieme, Leipzig, 1928.

<sup>43</sup>*Archives Roumaines de Pathologie Expérimentale et de Microbiologie*. Publiées sous la Direction de J. Cantacuzène. Tome I. Masson et Cie, Paris, 1928.

<sup>44</sup>*International Clinics*. Volume IV. Series 37, 1927. J. B. Lippincott Co., Philadelphia, 1927.

home owns 1673 mg. of radium and has 3 deep x-ray apparatuses, using 180 kv. at 6 milliamperes. Since 1910 they have treated 13,500 patients with malignancy. Forssell considers radium and x-ray as a local treatment of carcinoma only.

There are three articles dealing with duodenal ulcer, from Carson of London; Wilkie of Edinburgh; and Paterson of London. Schilling of Oslo discusses pneumoradiography of the kidney.

An interesting article by Oliver of Baltimore illustrates the medicine of the middle ages, with reproduction of illustrations.

Of the numerous contributions to *International Clinics*<sup>45</sup> I mention in passing, Garberson of Miles City, Montana, who gives a nice résumé of Tularaemia. Colp, of New York, describes pedicle grafts and their manifold applicability in surgery. Dudgeon and Patriek, of London, recommend a rapid diagnostic method which consists in taking a surface scraping of the tumors to be examined and spreading this out evenly on a glass slide. While still wet the spread is immersed in Schaudinn's fluid and then strained with hemalum and eosin, the entire process requiring from eight to ten minutes. Of 231 specimens examined, 9 diagnoses later were proved wrong in paraffin section.

Under the aegis of the Burke Foundation, Bryant has issued a volume on convalescent changes dedicated to the cause of better convalescent care.<sup>46</sup> This volume aims to be a source book for the guidance of the workers. It has been found that the community requires 10 per cent as a minimum of convalescent beds, based on the number of hospital beds needed.

The author enters into the history of convalescent care, describes in considerable detail the early convalescent aid at Vincennes (Paris) started in 1857. The Burke Foundation began in 1915. In the Cleveland hospitals, it is claimed, 85 per cent of hospital patients require convalescent care. The Houses of Rest in Russia are described; also the convalescent care to be found in the United States Army. Special attention is devoted to surgical convalescence and finally a literature of the subject is offered.

*Baby's Health Day by Day*<sup>47</sup> in art imitation leather binding, is a daily diary designed for the mother. I should say, rather than for the infant. Glancing at the uniformity of each page, there is some danger that the modern infant must suffer from monotony and standardization. The daily menu of the newborn, according to this booklet, appears to consist of milk, dextro-maltose, orange juice, cod liver oil, cereal, egg yolk, and "other foods." All the other amusement supplied for the baby seems to be outdoors, sleep, bath, temperature, bowel movement, and weight. I wonder how many mothers will keep such a record continually, certainly not the average multipara or mother of twins.

*The Cause and Control of Sex in Human Offspring*, by R. Clay Jackson,<sup>48</sup> "bound in beautifully embossed fabrikoid" is a most curious production by a layman who has gathered a tremendous amount of material from various sources, put it together, and has drawn unwarranted conclusions from this material. According to the author, meteorology is the controlling factor. The book is self published.

<sup>45</sup>*International Clinics*. Vol. 1, Series 38, J. B. Lippincott Co., Philadelphia, 1928.

<sup>46</sup>*Convalescence. Historical and Practical*. By J. Bryant. The Sturgis Fund of the Burke Foundation, New York, 1927.

<sup>47</sup>*Baby's Health Day by Day*. Professional Press, Inc., Chicago.

<sup>48</sup>*The Cause and Control of Sex in Human Offspring*. R. Clay Jackson. Allstrum Printing Co., Tacoma, Washington, 1926.

## Selected Abstracts

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### Ovarian Transplantation

Tuffier, Th., and Letulle, Maurice: Transposition of the Ovary with Intact Vascular Pedicle into the Uterus after Ablation of the Tubes (29 operations). *La Presse Médicale*, Paris, 1924, May 28, p. 465.

This operation has been devised by Tuffier in an attempt to conserve the function of menstruation and the possibility of fecundation in women in whom a double salpingectomy becomes necessary. As a preliminary, the uterus is dilated with laminaria tents, of increasing size, changed every 12 hours, until its whole cavity is large enough to admit the index finger or the thumb. Just before the laparotomy, the last tent is removed and the cavity is disinfected with tr. iodine. At operation, the tubes are removed, hemostasis being secured by ligating two of the three small branches of the ovarian artery which supply the tube; but rather than ligate the outer, or tuboovarian branch, it is better to leave the tubal fringe which is adherent to the ovary. After incising the uterus through the mucous membrane, either longitudinally or transversely, one ovary (or even both ovaries) either whole or reduced in size by resection, is introduced into the incision so that its greater part protrudes into the uterine cavity. The uterine wall is closed around the pedicle, and the pedicle itself fastened to the uterine serosa, care being taken not to constrict the vessels. The abdomen is closed without drainage.

The results have been satisfactory. The patients have menstruated regularly, with premenstrual pain in 20 per cent. There have been no pregnancies in these 29 patients, but Raymond Petit has had one case with delivery of a live child at term, while Estes, in 27 cases, reported 2 full-term living children and 2 miscarriages, at 3 and 4 months. The probability of pregnancy is not great, but the operation makes it possible that a young woman operated upon for double salpingitis might conceive.

In one case, Tuffier found it necessary to perform hysterectomy nine months later on account of intestinal obstruction from adhesions to the uterus on the side opposite to the transplantation. About one-third of the ovary was found protruding into the uterine cavity. The author thinks that this was not quite sufficient; on the other hand, if the whole ovary is in the cavity, it will act as a polyp. This specimen was studied microscopically by Letulle, who reported that the ovary was living and functioning. Many cysts were present, one of them being fairly large, as well as many corpora lutea "more or less old."

E. L. KING.

Sippel, Paul: Technique of Ovarian Transplantation. *Münchener Medizinische Wochenschrift*, 1926, lxxiii, 155.

Most previous ovarian homotransplants were intraperitoneal. There have also been devised intratubal (Martin) and adnexal stump transplantations. Extraperitoneal transplantations have been done in the abdominal wall or fascia by Unterberger and Tuffier and also in the vagina by Engel and Glass, and in the right breast by Brewitt. The success of the operation seems to be largely a ques-

tion of sufficient blood supply, insuring subsequent nutrition for renewed growth. Muscle or mesentery, therefore, seems particularly favorable from this standpoint.

Auto- and homotransplants have been made in the muscular and fascial layers. When these are done, the ovary must be transferred while still warm; in homotransplants the ovaries are transplanted immediately. In autotransplants the grafted ovaries are not carried over until the abdomen is ready to be closed. In one case the ovary and blood vessels were transplanted into the right rectus muscle. The grafted ovary healed perfectly and menstrual changes occurred regularly.

The difference in the subsequent clinical course between the intra- and extra-peritoneal operation is not clearly defined. In homotransplants various types of growths develop which finally hinder ripening of the follicles. Likewise cystic degenerative changes occur in autotransplants.

W. B. STAMIN.

Herschan, O.: Intrauterine Implantation of the Ovary with Preservation of the Ovarian Circulation. *Klinische Wochenschrift*, 1927, vi, 114.

The author reports two cases in which, following salpingectomy, the ovary together with its intact circulation was transplanted into the uterine cavity. In both cases normal menstruation was established following the operations. Neither case had been followed by pregnancy at the time of the report but Herschan does not see why this cannot occur. He recommends this procedure in all cases of bilateral salpingectomy where further pregnancies are desired. The method can even be used following a defundation. The implanted ovary does not act as a foreign body and there is apparently no danger of setting up an intrauterine infection or inflammation.

RALPH A. REIS.

Petinari, V.: Ovarian Grafts and Their Application to Therapy in the Human. *Gynécologie et Obstétrique*, 1926, xiii, 19.

The following conclusions are based on experiments made on 332 animals of different species. Ovarian tissue can be made to live and to continue the elaboration of the normal internal secretion, and even the germinal function, where the grafted tissue is from the same species as the receptor. The formation of corpora lutea is seen chiefly in the autoplasmic grafts, whereas, in the heteroplasmic grafts, follicle atresia is the rule.

Ovarian secretion which cannot be replaced by any of the other internal secretions can be resupplied to the needy organism by successfully grafted ovarian tissue. In this way, a whole series of disorders dependent upon the disordered endocrine function may be remedied.

For a graft to take, it is necessary for the organism to show an absolute or relative lack of the sexual hormone. A long period of castration, the absence of the uterus, or both, reduce the probability of a take. The physiologic effect is apt to be spasmodic, and to simulate rather than duplicate the normal function. At times, it may exaggerate it. A successful graft will prevent the appearance of the usual effects of castration, will carry the organism to its usual sexual development, and has on old animals a definite general specific action, causing a profound psychic and somatic change. Much of the work done to date lacks scientific value. Neither extreme optimism nor pessimism is justified.

The following syndromes may be favorably affected by ovarian graft: (1) Infantilism; (2) Castration with pathologic menopause; (3) Dysovarism, with ovarian insufficiency; (4) Ovarian sterility; (5) Pluriglandular endocrine syndromes; (6) Certain mental affections.

In the human, autoplasmic transplants give the best prognosis. Homoplasmic



grafts have occasionally been satisfactory. The tissue may be grafted into the genital organs themselves (uterus, tubes) or into tissue in the region of the genitals or even into other tissues at some distance from the pelvis. Grafts may be used to stimulate impotent ovarian tissue as well as to replace removed or destroyed tissue. Transplantation from chimpanzee to human has been tried and evokes interesting speculation. Ovarian grafts have great therapeutic possibilities and their use will become more general in the treatment of conditions not amenable to other ovarian therapy. At present they are to be used with discretion.

GOODRICH C. SCHAUFFLER.

**Pankow, O.: Ovarian Transplantation in Humans.** *Therapie der Gegenwart*, 1926, lxvii, 68.

The author transplants a piece of ovarian tissue into a place between the bladder and cervix or into the rectus muscle of the abdomen. In the latter instance he cuts a window in the fascia over the transplant to prevent pressure on it. He has removed such a transplant three and one-half years later and found primordial and ripening follicles.

Menstruation occurs in from 2 to 6 months and has continued for 8 years. The younger the patients the longer menstruation keeps up. If it does not occur in 6 months it will not appear.

Homotransplantation is used in patients who have been castrated; those who have an extreme degree of hypoplasia; and those who have hypofunction of the ovarian secretory apparatus. It is most beneficial in the last class. These patients menstruate at long intervals and if treatment with thyroid, ovarian and pituitary extract among other means does no good the transplantation may be tried. The longer the symptoms have continued and, especially the longer the time after castration, the less chance there is of obtaining a beneficial result.

Lately homotransplantation has been employed in dementia precox with some improvement because such patients frequently have hypoplasia of the genital organs. Sippel has used it in menorrhagia at puberty and at the climacteric on the theory that the corpus luteum does not form and the follicle persists causing the bleeding. He believes that introducing normally functioning ovarian tissue stimulates the patient's ovaries.

FRANK A. PEMBERTON.

**Loeser, A.: The Action of Ovarian Transplantation upon Infantile, Endocrine-Deficient, and Old Women.** *Medizinische Klinik*, 1926, xxii, 1637.

The author reports his experiences with ovarian transplantation during the past five years. The operation itself is absolutely harmless but good material is hard to obtain. The author did not use the ovaries from patients with cancer or pulmonary tuberculosis, nor did he use ovaries preserved on ice. He obtained functioning ovaries from patients on whom he performed myomectomy or suspension operations. A transplanted ovary must be imbedded in a place where there is active metabolism such as muscle, not fat.

The author performed 16 transplantation operations. There were 4 infantile women, 5 amenorrheic women who had many disturbances of internal secretion, and 7 women with menopausal symptoms after operative castration or premature menopause. In the infantile patients, there were no good results; neither were the results good in the amenorrheic women with internal secretory disturbances. However, in the patients who had previously experienced normal ovarian activity and who lost it by operation, transplantation produced a definite beneficial effect.

In these patients the transplanted ovary was not placed in a constitutionally sick but in a normal individual. The viability of the transplant is short, for in no case did the effect last more than a year and one half.

In two cases, ovaries from children were transplanted and both yielded good results.

J. P. GREENHILL.

Sippel, Paul: *The Homoplastic Transplantation of Ovaries in Schizophrenia.*  
*Klinische Wochenschrift*, 1925, iv, 401.

After the satisfactory results obtained by homoplastic transplantation of ovaries in primary and secondary hypogenitalism he enlarged the field of transplantation to schizophrenia. In schizophrenia (dementia precox) a considerable percentage of cases have a more or less pronounced hypoplasia and underfunction of the genital system. In a series of 176 such cases Fraenkel has found that 72 per cent showed infantile changes of the genitals in a severe form. Geller has concluded, with Mott, Fraenkel, Hauck, and Koehler, that there is a close relationship between subnormal genital function and dementia precox.

On the basis of these findings and his own researches, Sippel has to date transplanted ovaries to six young schizophrenic women. A close control of their psychiatric conditions was possible as these cases were kept in the Hospital for Mental Diseases at Dalldorf.

The operated cases were between eighteen and twenty-four years old. The majority showed a marked malnutrition and definite underdevelopment. The status of the genital system was definitely ascertained by means of diagnostic curettage and laparotomy, and revealed mild, medium, and severe grades of hypoplasia. In five cases the endometrium was entirely functionless. In three cases there was a mature ovum in the ovary and no corpus luteum formation. In two cases an old corpus luteum in advanced retrogression was found, which did not fit in with the stated menstrual period. In practically all cases there was pronounced disturbance of maturation of the ovum associated with a functional disturbance of the uterine mucosa due to hypoplasia.

Two girls, showing early schizophrenia with a light grade of hypogenitalism, showed progressive improvement two to four weeks after transplantation. Their hallucinations, negativism, and depressive symptoms disappeared almost entirely, their periods were more normal, they took on a healthy appearance and were discharged as improved two months after transplantation.

In one case, aged nineteen, with schizophrenia of two years duration and marked underdevelopment of the genital system, the psychiatric condition was unchanged after operation.

The author will report follow-up observations of these cases at a later date.

C. A. SAFFERT.

## Correspondence

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### The Baldwin Operation for the Formation of an Artificial Vagina

*To the Editor.*—Since the original publication of the method which I had devised for the making of a vagina in cases of congenital or acquired absence of that viscus (*Annals of Surgery*, September, 1904), a good deal has been written in regard to the operation, and relatively a large number of operations have been performed. The reports of deaths, particularly those in the work of foreign operators, have been most distressing to me because it had seemed to me that the operation properly performed should have a low mortality. Some of this mortality has apparently been due to unwise deviations from the original technic, and some perhaps to misunderstanding from lack of familiarity of the surgeons with the language in which my report appeared.

In my original description of the operation and in all my subsequent writings I advised the use of the lower end of the ileum for the formation of the vagina. I had previously examined the mesentery in many hundreds of cases, in connection with abdominal operations, and had always found it ample for the purpose in mind, and in my subsequent operations I have had no trouble in using that portion of the bowel. Because, however, of the possibility of a short mesentery I suggested the use of the sigmoid in case such shortness would preclude the use of the ileum.

The length of bowel to be utilized should be no more than enough to make a normal vagina. With that amount I have never had any complaint of any leucorrheal discharge, and in examining such patients later have never found more than the normal amount of moisture present. A Russian surgeon some time ago reported a series of cases which he had had in which there was present an annoying leucorrhea, but the x-ray pictures which accompanied his report showed that he had used an enormous excess of ileum.

The opening for the vagina should be made by a transverse incision at the proper point in the perineum. The line of cleavage would be found so that the separation of the bladder and the rectum could be made rapidly and safely. (In one case I had a good deal of difficulty in making this separation because a previous operator had attempted to construct a vagina by making an opening and packing it with gauze, expecting nature to cover the raw surface with mucous membrane. I found a mass of scar tissue, but was able to work through it without injury to bladder or rectum.)

In selecting the piece of bowel to be utilized its mesentery should be studied so as to be sure that the blood supply to that part of bowel is ample. The ends of the resected bowel should be closed by a purse string with inversion as usual, and the continuity of bowel should be restored either by lateral anastomosis or Murphy button; but care should be taken to so close the opening in the mesentery as to obviate postoperative ileus.

By means of a hemostat pushed through the mesentery at the center of the resected portion a strip of gauze is pulled through to be used for traction in bringing the bowel down through the new passage. After the loop of bowel is in place the floor of the pelvis should be carefully examined to see that all raw surfaces are covered over.

After completing the perineal work, as described in my original article, care should be taken to pack a sufficient amount of gauze in each half of the bowels so as to keep its peritoneal surface in snug contact with the raw surface of the new canal.

As stated in all of my communications on this subject, the operation is distinctly not one for a surgical tyro, but it is an operation which can be made by an expert without difficulty and with no more danger than would attend an ordinary operation requiring intestinal resection. The making of the new opening should certainly give no shock or hemorrhage. (In my own work I have had but one death, and that I am confident would not have occurred had the patient and her husband been intelligent enough to cooperate; but they were foreigners and would not allow stomach lavage or enemas and the patient died, but with no evidence of peritonitis. No postmortem was permitted.)

I have never been able to understand the statements of certain writers as to the alleged high mortality of the operation. The statistics, as far as I have seen them, have all been foreign and out of all proportion to those furnished to me personally by American surgeons. A satisfactory explanation of this mortality is afforded, however, by an abstract from the *Press Medicale*, in the *AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY* for May, 1928, page 734. In this abstract reference is made to ninety cases which had been collected with a mortality of 17 per cent. These fifteen fatalities were due to peritonitis in twelve cases, and in nine of these the peritonitis was due to intestinal gangrene! This report clearly solves the mystery of the mortality reported by these European surgeons. They certainly cannot be familiar with good surgical technic, or even with the principles of ordinary asepsis, to have such a number of deaths from peritonitis; particularly when so much of that peritonitis was due to failure to look after the blood supply to the loop of the bowel.

I may add that the method of operating which I originally described I have found entirely satisfactory. Several surgeons have suggested changes, but not one of those suggestions seemed to me to be any improvement, and several were decidedly objectionable. Incidentally I may state that within a few weeks the husband of my first patient, operated upon 21 years ago (*American Journal of Obstetrics and Diseases of Women and Children*, November, 1907), happened to come to the city from his distant home and called on me to report that his wife was still well and everything in every way normal. Her operation was necessitated by the complete loss of her vagina by sloughing following childbirth.

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### Menstruation and Pseudomenstruation

*To the Editor.*—The article by Professor Corner which appeared in the *Journal of the American Medical Association* (Nov. 26, 1927, lxxxix, 1838) has interested me greatly. In it the author describes two processes which occur in the female macacus rhesus, both accompanied by the same clinic symptoms; namely, periodically recurring bleeding from the vagina. The genesis of these two vaginal bleedings are evidently fundamentally different. In the one case, we are dealing with bleeding from a surface wound due to destruction following a specific endometrial change; in the second case we are evidently dealing with a hemorrhage due to diapedesis through a resting mucosa. It appears essential, therefore, to distinguish and give different names to these quite distinct processes. Unless this is done, confusion will arise in the study of the etiology. The same would apply to the confusion arising in clinic investigation if these two quite distinct processes

were regarded from the same point of view. As will be evident from my monograph, as well as the work of Robert Meyer and others, the cyclical process, together with the destruction of the mucosa, must be regarded as a consequence of the failure of impregnation and therefore as an important functional complex which deserves separate recognition and separate nomenclature. Menstruation, throughout the ages, has popularly been regarded as closely associated with pregnancy. It appears to be both necessary and logical to confine the term "menstruation" to the breaking down of the pregravid uterine mucous membrane. The hemorrhage which Corner describes, requires to be put under a different heading, as "menstruation-like bleeding," or "pseudomenstruation," the discovery of which in monkeys living under the artificial conditions of cage life are of extreme interest, particularly as they appear at relatively cyclical intervals. For a moment we are unable to explain these phenomena. Possibly one will find by means of systematic quantitative examinations for the female sex hormone in the blood of these animals that certain cyclical ripening processes may occur in their germplasm at puberty even before full physiologic ability to become impregnated has been reached and before ovulation actually takes place.

Clinically, a great number of nonmenstrual hemorrhages are known, of which in the second portion of my monograph I have given many examples. However, no identical, fully rhythmical types, such as Corner describes in the monkey, have yet been found in the human being. It will therefore be necessary to direct attention and research in human cases to see whether in them likewise cyclical recurrence of pseudomenstruations can be found. Up to date all such data are wanting in the human being. It would be of extreme value to submit the genitals of those monkeys which show the anomaly in question to an exact analysis of their germplasm function, and also to determine the number of follicles, the various stages in which found, and the exact morphology of the endometrium. Dr. Corner's valuable contribution will be enhanced if he does not designate these two types of genital bleeding with the name of "menstruation," reserving the term of "menstruation" for the final stage of an abortive pregnancy and calling the genetically different bleeding from the genitals by the name of "pseudomenstruation." Unless this is observed there is danger that the beginning clarification of our concept of menstruation will again be obscured.

(Signed) DR. ROBERT SCHROEDER, Professor, Director der  
Universitäts-Frauenklinik in Kiel.

## Books Received

ERGEBNISSE DER MEDIZINISCHEN STRAHLENFORSCHUNG (Roentgen-diagnostik, Roentgen-, Radium- und Lichttherapie). Band III. Mit 613 Abbildungen im Text. Verlag von Georg Thieme, Leipzig, 1928.

CHILDBIRTH. By William George Lee, A.B., M.D. The University Press of Chicago, 1928.

INTERNATIONAL CLINICS. Volume I. Thirty-eighth Series, 1928. J. B. Lippincott Company, Philadelphia, 1928.

THE USE OF SYMPTOMS IN THE DIAGNOSIS OF DISEASE. By Hobart Amory Hare, professor of therapeutics and diagnosis in the Jefferson Medical College of Philadelphia, etc., etc. Ninth edition, thoroughly revised. Illustrated with 124 engravings and 4 plates. Lea and Febiger, Philadelphia, 1928.

THE RATE OF LIVING. Some experimental studies on the biology of life duration. By Raymond Pearl, Johns Hopkins University. Alfred A. Knopf, New York, 1928.

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## Original Communications

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### AN OUTBREAK OF PUERPERAL SEPSIS IN NEW YORK CITY\*

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New York

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**D**URING the months of January and February, 1927, there occurred in the Sloane Hospital for Women, New York City, a series of cases of streptococcal puerperal infection which in their number, in their mode of incidence, and in their severity constituted a veritable epidemic. As an occurrence of this nature is now happily rare it seemed to us that a detailed account of the facts regarding it ought to be put on record, and an attempt made to examine the possible factors concerned in the initiation and spread of the disease.

During November and the early part of December, 1926, the puerperal morbidity rate as shown by the numbers of cases with temperatures over 100.4° F. was higher than normal. As a result of this a review of our technic was made. Two of the chief changes made at this time were the discontinuance of the use of lubricant soap solution in "ironing out" the vagina in primiparae, and the insistence on the wearing of masks by all those in attendance at deliveries. At the same time an order was given that vaginal examinations were to be reduced to a minimum. Details of the technic used will be found in the appendix.†

During the latter half of December and the first half of January, the morbidity rate was an average one and there were no serious cases of infection.

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\*Read at a meeting of the New York Obstetrical Society, January 10, 1928.

†In the reprints.

## SEQUENCE OF EVENTS

On January 18, there was admitted to the hospital Mrs. L., a multipara, in labor. She gave a history of having had a severe cold for a week before. She had no temperature on admission. She had a normal labor, in the course of which one vaginal examination was made, and was delivered in the east operating room without laceration. On the third day her temperature rose to 100.8° F., and on the fourth day it reached 103° F., and from then till her death on the seventeenth day it ranged between this and 105° F. Lochial and blood cultures showed a streptococcus hemolyticus.

On the night of the same day, January 18, cesarean section was performed on Mrs. J., in the north operating room. This patient had been admitted on January 17 and had had feeble pains and ruptured membranes for twenty-four hours. One vaginal examination had been made. Her temperature remained below 100° F. until the fourth day, when it rose to 103.6° F. Thereafter it was sustained between 104° and 106° F. until the thirteenth day when she died. Hemolytic streptococci were recovered from her blood before death and from the peritoneal cavity after death. She also had a terminal pneumonia.

On January 19, cesarean section was performed in the north operating room on Mrs. N., who had had a trial labor of twenty hours and had membranes ruptured for two hours. One vaginal examination was made. Within twenty-four hours of operation her temperature rose to 104° F. She died on the fifth day. Upon opening the abdomen peritonitis was found and a hemolytic streptococcus recovered.

On January 20, Mrs. C., was delivered by cesarean section in the north operating room. No vaginal examination was made. She had a temperature of 99.6° F. when she was admitted to the hospital on January 14, but thereafter until she was operated she had a normal temperature and blood count. On the night of operation she had a very rapid pulse and the following day her temperature rose to 105.4° F. This temperature was maintained until she died on the third day. Signs of double basal pneumonia were present before death. No autopsy could be obtained and no blood cultures were taken. This was the first death to occur, and it was ascribed to postoperative pneumonia but in all likelihood it was a true septicemia.

On January 20, Mrs. F. was delivered by forceps in the private operating room. No vaginal examination was made prior to the operation. She ran a perfectly smooth course until the fifth day when she had a chill and her temperature reached 104.2° F. This temperature was maintained with slight remissions for ten days when it reached normal. For the next eight days it was remittent and on the twenty-third day a pelvic abscess was opened per vaginam. She was discharged well on the fortieth day. Blood cultures repeatedly taken were negative but lochial culture and cultures from the pus of the pelvic abscess showed a hemolytic streptococcus.

On January 20, Mrs. E. had a normal delivery in the east operating room. She had had fever for three days before admission when her temperature was 99.4° F. For eight days after delivery her temperature was not above 100° F. except on the fourth day when it reached 102.8° F. On the ninth day it rose to 104° F., and remained there for two days after which it gradually dropped to normal. She was discharged well on the twenty-sixth day. A hemolytic streptococcus was recovered from her cervix on the twelfth day and from a small abscess in the buttock, the site of a quinine injection on the eighteenth day. Blood culture was persistently negative.

On January 14, Mrs. B. was admitted to a private floor. She had had a severe cold with a temperature of 103° F. at home. On admission the temperature

was normal but on two occasions, on January 18 and January 23, it reached 99° F. She was delivered in the private operating room on January 24 after a normal labor in the course of which the only examination or interference was the artificial rupture of the membranes at the vulva. Within thirty-six hours her temperature reached 104.6° F. and in the course of the second day it rose to 107.6° F. She died on the third day. Hemolytic streptococci were found in the blood during life, and a partial autopsy showed peritonitis with an abundant growth of streptococcus hemolyticus.

On January 26, Mrs. P. was admitted and had a normal delivery with a first degree laceration in the east operating room. One vaginal examination was made. On the third day the temperature rose to 103.8° F. and varied between this and 105.6° F. until the seventh day after which it fell to below 103° F. For the next thirty days it fluctuated between 99° and 103° F. Thereafter it was normal and she was discharged well on the fifty-first day. Repeated blood cultures were negative but vaginal culture showed a streptococcus hemolyticus.

On January 27, Mrs. D. had a normal delivery in the east operating room. One vaginal examination was made. She had a laceration which was repaired. Temperature rose to 104° F. on the eighth day with a chill. It gradually fell to normal on the tenth day. Blood culture was negative. Vaginal culture showed streptococcus hemolyticus.

On January 29, Mrs. T. had a normal delivery with a first degree laceration in the east operating room. Three vaginal examinations had been made. She had a temperature of 99.4° F. during labor. On the third day temperature rose to 104.6° F.; it was sustained with slight remissions until she died on the ninth day. Vaginal culture and blood culture showed a streptococcus hemolyticus.

On the same day, January 29, Mrs. W., had a normal delivery in the east operating room. One vaginal examination was made. Her temperature during delivery was 99° F. On the third day it rose to 103.2° F. It reached 106.4° F. on the fourth day and thereafter quickly fell to 102° F., and from there fell by lysis to normal on the fifteenth day. She was discharged well on the eighteenth day. Blood cultures throughout were negative. Vaginal cultures showed a streptococcus hemolyticus.

On January 20, Mrs. F. had a normal delivery in the east operating room. One vaginal examination was made on account of some bleeding at the beginning of labor. She was a diabetic. Temperature remained normal until the ninth day when it suddenly rose to 105° F. with a chill. It was sustained at this level for two days and gradually came down, by lysis, to normal on the thirteenth day. She was discharged well on the twenty-third day. The lochia showed a streptococcus hemolyticus which was still present on discharge. Blood culture was negative.

On January 31, Mrs. McG. had a normal delivery in the east operating room. One vaginal examination was made. Temperature remained normal to the fourth day when it rose to 101° F. It reached 104.4° F. on the fifth day. She died on the twentieth day. Blood cultures were positive for streptococcus hemolyticus and vaginal cultures showed the same organism.

On February 2, Mrs. R. was delivered in the east operating room by low forceps after manual rotation of the head. No vaginal examination was made before the forceps application. Temperature remained normal to the third day when it rose to 103° F. Her temperature was sustained about this level until the thirtieth day when it gradually dropped by lysis, and the patient was discharged well on the fifty-first day. A pelvic cellulitis developed but did not suppurate. Vaginal culture showed streptococcus hemolyticus but blood cultures were persistently negative.



On February 2, Mrs. C. was delivered in the east operating room by forceps after rotation of head. She had a temperature of 101° F. at the time of delivery; within a few hours it reached 104° F. and on the second day it rose to 105° F. with a chill. Thereafter it gradually fell and she was discharged on the fifteenth day. A hemolytic streptococcus was cultured from the vagina but none from the blood.

On February 4, Mrs. L. was delivered in the east operating room. She had a severe cold at the time of delivery and had a temperature of 99° F. On the second day temperature rose to 103.8° F. with a chill. It was sustained for two days at this level; gradually fell to 100° F. which it reached on the eleventh day. It was thereafter normal until her discharge on the twenty-second day. She had an inflamed patch on the right tonsil. On the fifteenth day some induration could be felt in both broad ligaments. This had entirely disappeared on her discharge. Vaginal and blood cultures were negative for streptococcus. Throat culture showed a nonhemolytic streptococcus.

On February 5, Mrs. B. was delivered in the east operating room. She had a normal delivery and sustained a second degree laceration. No vaginal examination was made. On the fifth day temperature rose to 103.4° F. It gradually dropped to normal on the twelfth day. She was discharged on the seventeenth day. Blood culture negative. Vaginal culture showed streptococcus hemolyticus.

On February 7, Mrs. M. had a normal delivery in the east operating room. One vaginal examination was made. Cultures from the vagina on the second day postpartum were positive for hemolytic streptococcus but she had no temperature until the fifth day when it rose to 105° F. with a chill. She ran a long course and died on the seventy-fifth day. During the course of her illness localized abscesses formed in the peritoneum; two of these were opened. At no time had she a positive blood culture.

On February 9, Mrs. S. had a normal delivery in the special delivery room on the sixth floor. One vaginal examination was made. On the fourth day her temperature rose to 102° F. at which level it remained for three days and then gradually fell to normal. She was discharged well on the sixteenth day. Vaginal culture showed streptococcus hemolyticus. Blood cultures were negative.

On February 9, Mrs. S. was delivered by cesarean section in the north operating room. No vaginal examination made. Temperature remained below 100° F. until the fifth day when it suddenly rose to 105° F. It remained between 101° and 104° F. until the tenth day when it fell by lysis to normal; it was persistently normal after the twentieth day. She was discharged well on the twenty-fourth day. The abdominal wound healed by first intention. Blood culture was negative throughout. Lochial culture showed a streptococcus hemolyticus.

On February 10, Mrs. B. was delivered by forceps in the private operating room. No vaginal examination before forceps application. She had had a hemolytic streptococcal infection of the nose a year before, and there was a recurrence of throat trouble with a temperature of 103° F. before admission. On the third day postpartum the temperature reached 104° F.; it reached this level again on the fourth day, fell by lysis and was persistently below 100° F. until the twenty-sixth day when it reached 102° F. and then went to 105.2° F. on the thirtieth day. At this time some induration was found in the cellular tissue of the pelvis. She ultimately made a complete recovery and was discharged on the fifty-sixth day. Blood culture throughout was negative. Vaginal culture showed the streptococcus hemolyticus.

On February 10, Mrs. C. had a normal delivery with a second degree laceration in the special delivery room on the sixth floor. On the fourth day temperature

rose to 102° F., it was sustained at this level for three days and fell by lysis to normal. Patient was discharged well on the thirteenth day. Vaginal culture showed *streptococcus hemolyticus*. Blood culture was negative.

Mrs. C. had a normal delivery on February 12 in the special delivery room on the sixth floor north. On the second day temperature rose to 103° F. It was remittent between 100° and 105° F. until the forty-first day. An inflammatory mass developed on the right side of the pelvis and in front of the uterus. This was drained on the forty-first day. This temperature gradually came down reaching normal on the forty-ninth day. Patient was discharged on the fifty-seventh day when there was still some thickening to be felt on the right side. Blood cultures and vaginal cultures were negative for *streptococcus hemolyticus*.

On February 13, Mrs. W. was delivered by low forceps in the private operating room. On the second day she had a chill and her temperature rose to 103° F. It returned to normal on the fourth day and did not rise again. Blood culture was negative; vaginal culture showed a hemolytic streptococcus.

On February 14 admission of patients to the wards of the hospital was stopped. A private patient, Mrs. S., admitted on that day, was delivered by forceps in the private operating room on February 18. Her temperature remained normal until the fourth day when it rose to 104° F. with a chill. It remained at this level for the next three days when it fell suddenly reaching normal on the eighth day where it remained until the eleventh day when it rose, suddenly, to 106° F. with a chill. By the twelfth day it had again reached normal and so remained until her discharge on the twentieth day. Repeated blood cultures were negative. Vaginal cultures showed a *streptococcus hemolyticus*.

The hospital was reopened on February 24.

On March 14, Mrs. F. was delivered by forceps in the private operating room. On the third day her temperature rose suddenly to 104° F. with a chill. She became very restless and soon was in a condition of acute mania, so that on the fifth day she was transferred to Bellevue Hospital. *Streptococcus hemolyticus* was cultured from blood obtained on the fourth day. She died in Bellevue on the seventeenth day. No autopsy was done.

#### SUMMARY

During the period January 16 to February 14 one hundred and sixty-three patients in all were delivered. Of these twenty-four, or approximately fifteen per cent, showed evidence of streptococcal infection. One case developed after February 14 and died. The number of deaths in the twenty-five cases was nine, a mortality of thirty-six per cent. During the same time twelve other patients had morbid puerperia with temperatures of 100.4° F. or over. In none of these were streptococci demonstrated and in none was there gross evidence of uterine infection. Five of them had evidence of pyelitis and all made a rapid recovery. Two patients with hemolytic streptococci in the vagina had no temperature.

The methods of delivery in the twenty-four infected cases were as follows:

Normal	-----	13
Forceps	-----	6
Cesarean section	-----	4
Version in twins	-----	1

Vaginal examinations were made as follows:

Normal cases	5-----no examination
	7-----one examination
	1-----three examinations
Forceps cases	3-----no examination
	3-----one examination
Cesarean sections	2-----no examination
	2-----one examination

In seven of the whole series, therefore, no vaginal manipulation of any kind was carried out.

*Streptococcal Infections in Infants.*—Only one infant had an infection during this period. It was the child of an infected patient, Mrs. P., and it was separated from its mother when it was four days old. It developed a general erysipelas on the sixteenth day and died.

*Streptococcal Infections in the Staff.*—Twenty nurses and two attending surgeons had hemolytic streptococci in the throat or nose during the period of the epidemic. Four nurses had tonsillitis.

On January 31 a nurse who was nursing an infected patient pricked her finger with a safety pin. In twenty-four hours the arm became painful, the temperature rose and she became very ill. She was transferred to the Presbyterian Hospital where later the arm and axilla were incised. A hemolytic streptococcus was obtained from the pus. Blood cultures were negative. She recovered.

On February 14 at 6:30 P.M. a nurse, Miss S., complained of feeling chilly. She was taken off duty and at 7:30 P.M. her temperature was 101° F. Her only complaint was pain in the back and legs. The following afternoon she complained of abdominal distress which soon became acute pain and her temperature rose to 104° F. She was transferred to St. Luke's Hospital. On the evening of February 16 the abdomen was opened. A general peritonitis was found with no primary lesion demonstrable. A hemolytic streptococcus was recovered from the peritoneal fluid. She ultimately made a good recovery. She had had no sore throat, but there was swelling of the glands of the neck. She had a negative throat and nose culture. She had not been in contact with infected cases in the wards, but on February 10 had assisted at the delivery of Mrs. B., who subsequently developed infection.

The sum total of the epidemic, therefore, includes twenty-five puerperal infections with nine deaths, one fatal case of erysipelas in an infant, one streptococcal cellulitis in a nurse, and one primary peritonitis in a nurse.

#### EPIDEMIOLOGY

Like some other epidemics the present one got under way and was in full swing before we realized what was happening. It is only on looking back and reviewing the various occurrences that we can piece together the story. In the three days, January 18, 19, and 20, seventeen patients were delivered in the hospital. Six of them developed

a virulent streptococcal infection and four of them died. Of these six patients three were delivered by cesarean section in the north operating room on the seventh floor; two had normal deliveries in the east operating room on the ground floor; and one was a forceps delivery in the private operating room on the third floor. These six patients before and after delivery were on different floors of the hospital, two of them in private rooms on the second floor, two in separate public wards on the third floor, two in separate wards on the fourth floor before delivery, and in the same ward after delivery. The three cesarean sections were performed by different operators but the operating room staff was the same in all cases. In the same operating room and with the same staff seven gynecologic laparotomies were performed between January 18 and January 21 and on the latter date another cesarean section. All of these patients had a perfectly normal convalescence. The routine gynecologic operating of the hospital was carried on in this operating room until February 9 with absolutely no untoward results. There were no wound infections or other evidences of sepsis in these patients.

The supplies for the north operating room, where the cesarean sections were done, were sterilized in the sterilizing room attached to it. The supplies for the east operating room and for the private operating room were sterilized in the east operating room. All sterilizers in the hospital are under clock control and are checked once a week by culture. Examination of dressings, sponges, gloves, etc., subsequent to the outbreak of the epidemic proved them to be sterile.

The sterile water supply is separate for each operating room. A check-up of this at a later date showed absolute sterility in the hot water supply throughout but from one of the cold water tanks a few organisms were obtained but no streptococci.

The senior resident assisted at all three cesarean sections and delivered the one patient in the private operating room, but he was not present at the two deliveries in the east operating room.

The attending surgeon who operated upon one of the cesarean sections had examined one of the other two vaginally two days before, but he was not present at the third.

The same intern delivered the two patients in the east operating room but took no part in the cesarean sections or in the delivery of the patient in the private operating room.

There is an interchange of nursing staff between the east operating room and the private operating room, but the north operating room staff is quite separate.

It, therefore, seems impossible at this stage to find a common factor applicable to all the cases.

The first likely clue we had to follow was that the next six patients to develop infection were all delivered at night. The night intern delivered five of the patients in the east operating room and gave the

anesthetic to the sixth in the private operating room. He had also delivered two of the patients among the first six infected. The night operating room supervisor assisted at all of them. Nose and throat cultures from the intern and the supervisor showed the presence of a streptococcus and both were taken off duty on January 31; that was thirteen days after the delivery of the first patient to show infection. The intern was sent on a vacation and did not return, as his term of service ended shortly after, so that no further cultures could be obtained from him. This was unfortunate as his organism eventually proved to be a streptococcus viridans. The organism from the nurse also was found by Dr. Meleney to be of a different strain from that of the infected patients.

Cultures from the throat and nose of the attending surgeon who performed the first, and examined the second fatal cesarean section, and later delivered the patient in the private operating room, who developed infection, were positive for hemolytic streptococci. Subsequent detailed examination of these cultures by Dr. Meleney showed the organism to be of a different strain from that of the infected patients.

All that we had to go on, therefore, at this stage was that certain individuals in the hospital were harboring streptococci in the nose and throat. These individuals were, therefore, excluded from contact with patients.

In spite of the change of the night staff, and the exclusion of others who were carriers, as they were found, three patients delivered in the east operating room during the following week became infected. This operating room was, therefore, closed and all deliveries were conducted in the clinic room on the sixth floor, one of the gynecologic wards being used as a first stage room. Three patients delivered there developed infections, as did also one delivered in the private operating room, and one delivered by cesarean section in the north operating room. We then seemed to be at the end of our resources and stopped admission of patients to the hospital on February 14.

The hospital remained closed for ten days and on February 24 was reopened. The first case admitted was a patient in labor who subsequently was found to have a gonococcal infection. She had a febrile puerperium but no streptococci were found. She gave us some anxiety until we were certain of the diagnosis. No other patient had a febrile puerperium until on March 17, Mrs. F., delivered by forceps in the private operating room on March 14, had a sudden rise of temperature with a chill. Streptococci were recovered from her blood on the fourth day of her illness. She developed acute mania and was removed to Bellevue Hospital where she died on the seventeenth day. Since that time there have been no streptococcal puerperal infections in the hospital.

Early in the epidemic it was noted that certain of the infected patients had had a temperature before delivery and it was thought possible that they might be harboring streptococci in some part of the body and that invasion of the uterus and generalized spread occurred in the early puerperium. Twelve of the twenty-four patients had a temperature of 99° F. or over before or during parturition; three of them had severe colds before their admission to the hospital and stated that they thought they had had fever. One patient was known to have had a temperature of 103° F. the day before she entered the hospital, on January 14. She was in a private room in the hospital for ten days before delivery took place. During this time her temperature rose to 99° F. on two occasions. She died on the third day following delivery of streptococcal infection.

In those early cases bacteriologic examination of the nose and throat was not made. In a large number of patients examined subsequently only one was found to have hemolytic streptococci in the throat. This, together with Dr. Meleney's later work which showed that the streptococci recovered from the fatal and severe cases were nearly of one strain, rendered it unlikely that the individual patient brought in her own organism.

While the epidemic was in progress, we heard from time to time of infections occurring in other hospitals both obstetric and surgical and we wondered whether 1927 might be a "streptococcal year" analogous to an "influenza year." Several aural surgeons informed us that during the early part of 1927 there was an unusual number of severe streptococcal sinus and mastoid infections in New York. With the hope of being able to throw some light on this a questionnaire was sent this autumn to a number of obstetric hospitals throughout the country asking if there had been noted any increased incidence or increased severity of streptococcal infections during the early months of 1927. Twenty-four hospitals replied and of these seven stated that the morbidity and mortality rates from streptococcal infections were distinctly higher than the average; seventeen stated that there had been no increase. Five of the seven hospitals which had noted an increase were in the area of greater New York or its immediate vicinity, one was in Baltimore, one in Philadelphia. One of the replies stated that there had been a thirty-three per cent increase over the average of streptococcal infections but no deaths. In one hospital there had been three deaths and in one six deaths. Five of the hospitals stated that there had been an increased incidence of streptococcal infection on the surgical services attached to or affiliated with them. In three there had been a noteworthy incidence of streptococcal infection among the members of the staff.

It would thus appear that during the early months of 1927 there was an increased incidence of streptococcal infection in the eastern part

of the country. Whether that increased incidence was due to the greater prevalence of the organisms, their greater virulence, or a general increase in susceptibility cannot be said.

It is interesting to note that there was an increased prevalence of scarlet fever in the United States during the later months of 1926 and the early months of 1927.\*

Dafœ† reported an epidemic of puerperal hemolytic streptococcal infection with eight deaths in the months of January and February, 1924, in Toronto General Hospital. He states that these cases "were coincident with other cases of puerperal sepsis of a similar type in various other hospitals and in private practice. At the same time there was a marked prevalence of sore throats, sinus infections, and middle ear trouble throughout the city." In the investigation of this epidemic hemolytic streptococci were found in the noses or throats of the two house surgeons, in nine out of twenty-five students, and in fifteen per cent of the nurses.

The *streptococcus* recovered from the Sloane patients was an extremely virulent one. As Dr. Meleney will show in his paper, it was so constant in type in the different cases that it must have come from a common source. How it acquired its virulence or how it was first introduced we have failed to prove. The fact that it was recovered from the vagina of every infected patient seems to be proof that it entered the body by this route. In none of the patients examined in the latter part of the epidemic or in the three months following it were streptococci found in the vagina prior to delivery. The inference must be that the organisms got into the vagina at the time of labor or in the early puerperium. As the only place in the hospital where hemolytic streptococci were found was the throat or nose of certain doctors and nurses the inference is that the organisms were spread to the cases in this way.

#### MEASURES TAKEN TO CHECK THE EPIDEMIC

As soon as it became evident that infection was present in the hospital careful check was made on all technic. Vaginal examinations were forbidden except when absolutely necessary and were then made only by an attending or the senior resident after complete iodine preparation of the vulva and vagina and full sterile draping as for delivery. We had not used mercurochrome as a routine in the hospital and considered it safer to adhere to a technic with which we were all familiar and which had proved satisfactory in the past. (See appendix.) As previously mentioned bacteriologic examination of all dressings, gloves, and sterile water was carried out. Masks which had previously been worn had, in many cases, not fully covered the nose. On January 28 we asked Dr. Meleney to come to our assistance. He pointed out the importance of masking the nose completely as well as the mouth. From that date complete masking was carried out. The masks were worn not only in the delivery room but in the first and second stage rooms by all doctors and nurses. On February 5 every member of the attending, resident, intern, nursing, and domestic staff had throat and nose cultures taken and these were repeated at weekly intervals. No one with a positive culture of *streptococcus*

\*Public Health Reports, xlIII, No. 3.

†Edin. Med. Jour., xxxII.

hemolyticus was allowed to come in contact with a patient before, during, or after delivery. A certain number of nurses with positive cultures were assigned to nursing the already septic patients. All others with positive cultures were excluded from the hospital. Every nurse was masked when doing postpartum dressings. The night intern who had a positive culture was sent on a vacation. The two attending surgeons with positive cultures did not visit the general labor room or public wards. They did for a time visit their private patients but were completely masked when they did so. Students were excluded from the hospital.

After the first evidence of infection in the patients delivered in the north, east, and private operating rooms the walls and floors of these were thoroughly washed with soap and water and chloride of lime. As the cases still continued in the east operating room it was closed on February seventh, and thereafter all patients were delivered in the gynecologic examining room on the sixth floor north, one of the gynecologic wards being used as a first stage room. Of the patients delivered there during the next week three developed infection. It was then decided to stop all admissions to the hospital. This was done on February 14 and no patients were admitted from then until February 24. Meanwhile the operating rooms had been fumigated with formalin and completely repainted. The entire ward side of the hospital, including halls, stairways, and pantries, was painted. Every mattress and pillow in the hospital was sterilized and remade, new ticking being used throughout. All blankets were washed. These measures were evidently effective for after the reopening on February 24 no other cases occurred except the isolated one on March 14. The Superintendent has computed that, apart from the loss of revenue due to cancelled reservations, the cost of the epidemic to the hospital was over six thousand dollars.

For three months after the reopening of the hospital, cultures were taken from the vagina of every patient on admission, at the beginning of labor, at the end of labor, and on the second, fourth, and seventh days postpartum. During this time no hemolytic streptococci were found.

The precautions regarding vaginal examinations and the masking of nose and mouth by every one in the first and second stage rooms as well as in the delivery room have been adhered to. Every nurse before she enters the hospital must bring from her school a report that cultures have been taken from the nose and throat and that they are negative for hemolytic streptococci. Weekly cultures of the Staff are being taken during the winter months. It is interesting to note that so far this winter not a single hemolytic streptococcus carrier has been found.

#### ISOLATION OF INFECTED CASES

In the Sloane Hospital there is no isolation wing. Two of the wards at the end of the corridor on the fourth floor are used as septic rooms. They have their own utility room.

It was a rule of the hospital that when a patient developed a temperature of 100.4° F. or over she was removed to one of these wards. This rule was adhered to before and during the epidemic. As the cases increased other wards on the same floor were used for the infected cases. These were shut off from the rest of the floor by a door. After February first all attending surgeons and interns were excluded from this part of the floor, the Director and Obstetric Resident being the only doctors who visited or handled the patients, and they did not visit other wards or take part in the delivery of patients. Gowns, caps, and masks were worn by them while on the floor. Nurses were put under isolation rules and were made to change their dresses before leaving the floor. All bed linen and dressings were soaked in strong lysol solution before being sent from the wards to the laundry. All dishes were disinfected immediately after use. In the later part



of the epidemic cultures were made from the vagina of every patient before delivery, after delivery, and on the second, fourth, and seventh days of the puerperium. In three patients hemolytic streptococci were found on the first postpartum examination and these individuals were at once isolated. One developed infection on the fifth day and died; the other two showed no symptoms.

The experience we have gone through emphasizes the necessity for a self-contained isolation unit in every maternity hospital. Our improvised arrangements proved to be ineffective and, looking back now, we regret that we did not close the hospital earlier than we did.

#### CLINICAL OBSERVATIONS

Under this heading there will be discussed the mode of incidence of the disease, its general course, the blood picture, the occurrence of streptococci in the blood and in the lochia, and the terminal results.

*Mode of Incidence.*—The time after delivery at which the first rise of temperature occurred is of interest. In the great majority of cases this rise occurred suddenly to 103° F. or over and was accompanied by a definite chill. In two cases the rise occurred within twenty-four hours; in one, it was on the eighth day; and in one, on the ninth day postpartum. In the majority of cases the rise took place on the third, fourth, or fifth day, the average time for twenty-four cases being 3.75 days postpartum. This rather late appearance of temperature and especially the occurrence of the two on the eighth and ninth days made us think at one time that the infection might be getting into the patients not at the time of delivery but in the puerperal period, and this led to a very thorough investigation of the bedding and dressings which Dr. Meleney will mention in his paper. It may be said now that no streptococci were found anywhere in the environs of puerperal patients in normal wards. We have, therefore, no proof that infection occurred after delivery.

After the initial rise, the temperature was usually maintained with slight remissions for several days, and in those who recovered, the remissions became greater and a gradual fall took place while in the fatal cases the remissions became smaller with a gradual rise until death occurred. The highest temperature recorded was 107.6° F. on the second day postpartum. The patient died within twelve hours. The temperature curve was markedly influenced by serum and quinine treatment. In the patients who recovered there was a drop of several degrees after intravenous serum and after intramuscular quinine administration. The drop was not so constant or so great after blood transfusion.

At the time of the rise of temperature the pulse also rose and the two curves as a rule ran together. In the first patient who died after cesarean section the first indication of anything wrong was a pulse of 140 on the night of operation so that an internal hemorrhage was suspected. Her temperature did not rise until twelve hours later. In all the others, temperature and pulse rose at the same time.

Abdominal distention was a prominent symptom in fourteen of the cases. Of these, seven were fatal and seven nonfatal. Diarrhea was noted in three fatal cases and in four that recovered.

In six of the fatal cases signs of consolidation and friction at the bases of the lungs appeared. It was most constant and most marked on the left side. It usually appeared just about the time at which the first positive blood culture was obtained and, taken along with this, we came to regard it as a bad prognostic sign. In such cases as came to autopsy the bases of the lungs showed fibrinous pleurisy, sometimes with fluid, and a lymphatic interstitial pneumonia (see autopsy reports).

As a general rule the involution of the uterus was delayed, and there was never more than slight uterine tenderness.

In eight cases, all of which recovered, there was inflammatory exudate in the pelvis and in two of these, abscesses formed. In no case was there an excessively foul lochia but in eleven it was noted as fetid or slightly fetid.

*Blood Picture.*—In Table I a summary and average of all the blood counts in the twenty-four cases is given. The average leucocyte count at the beginning of the infection was 19,800 with 84 per cent polymorphonuclear, and 71.5 per cent hemoglobin. At the height of the disease the corresponding figures are 25,000; 88 per cent; and 57 per cent. The highest leucocyte count was 41,400 with 91 per cent polymorphonuclears. This patient was a diabetic whose illness began on the ninth day after delivery and she recovered. In only one case did the leucocyte count never reach 10,000. This was Mrs. B., who died on the third day after delivery. Her highest count was 9,800 with 86 per cent polymorphonuclears.

TABLE I. SUMMARY OF BLOOD FINDINGS IN 24 CASES OF STREPTOCOCCAL PUERPERAL INFECTION

		LEUCOCYTES	POLYMORPHONUCLEARS	HEMOGLOBIN
First blood examination after rise of temperature	Average	19,800	84%	71.5%
	Maximum	41,000	91%	78.0%
	Minimum	9,800	86%	54.0%
Blood examination at height of infection	Average	25,000	88%	57.0%

In four patients there was a sudden drop in the number of leucocytes in the course of the disease, three of these patients died and one recovered.

One of them, Mrs. J., had a drop from 19,000 with 93 per cent polymorphonuclears on the third day of her illness to 8,000 with 86 per cent polymorphonuclears on the fifth day. Two days later the count was 11,000 with 74 per cent polymorphonuclears. She died three days later.

Mrs. T., had a drop in her leucocyte count from 18,000 with 85 per cent polymorphonuclears on the second day of her illness to 8,800 with 90 per cent polymorphonuclears on the fourth day. The count rose to 25,000 with 92 per cent polymorphonuclears two days later and she died the following day.

Mrs. L., had a leucocyte count of 18,000 with 86 per cent polymorphonuclears on the first day after illness. Four days after it had dropped to 5,700 with 89 per cent polymorphonuclears. It rose to 15,900 in two days and then to 25,000 with 92 per cent polymorphonuclears in three days more. She died two days later.

Mrs. F., had a drop from 15,000 with 80 per cent polymorphonuclears on the second day to 7,000 with 79 per cent polymorphonuclears on the fifth day. In four days the count rose to 33,000 with 90 per cent polymorphonuclear leucocytes. About the same time a definite inflammatory mass developed in the pelvis which later suppurated, was drained, and she recovered.

There was a marked drop in hemoglobin values in practically all cases. The average value at the beginning of the infection was 71.5 per cent and there was an average drop of 14.5 per cent during its course to an average low reading being 57 per cent. The beneficial effect of transfusion is shown in Table II.

TABLE II

HEMOGLOBIN DETERMINATION IN TRANSFUSED CASES		
Total number of transfused cases		11
At beginning of infection	71.5%	
Lowest reading	52.5%	
Reading on discharge or death	60.1%	
HEMOGLOBIN DETERMINATION IN NONTRANSFUSED CASES		
Total number of nontransfused cases		14
At beginning of infection	73.25%	
Lowest reading	66.00%	
Reading on discharge or death	66.00%	

*Blood Cultures.*—Blood cultures were made repeatedly in all cases except one. From seven patients a hemolytic streptococcus was recovered. Six of these seven patients died. The one who recovered gave a single colony on the twenty-sixth day and none thereafter. It is interesting to note the first day postpartum on which the positive blood cultures were obtained, viz.: the second, fourth, eighth, tenth, eleventh, eighteenth, and twenty-sixth (see Table III). The late stages at which the streptococcus was culturable from the blood stream would suggest that the first dissemination of the organisms was by the lymphatics and that from there they reached the blood. This is supported by the findings in the cases which came to autopsy, in all of which there was direct evidence of lymphatic involvement. The occurrence of peritonitis in four, and of pleurisy in one, also is evidence of lymphatic spread. Of the sixteen patients who recovered eight developed an inflammatory exudate in the pelvis and two had symptoms of articular inflammation both of which are usually indicative of a lymphatic spread.

*Vaginal Cultures.*—In eighteen of the twenty-four patients a hemolytic streptococcus was grown from vaginal smears. In five no smears were

taken and one was negative. The material for culture was taken from just within the vaginal orifice. In one of the earliest cases the cervix was exposed by a speculum and the smear taken from inside the cervical canal. Within an hour she had a chill and the temperature rose to 104° F. although it had been below 102° F. for the previous two days. She ultimately made a good recovery, but thereafter we avoided taking intrauterine or cervical cultures. The number of positive findings proved the method adopted to be adequate for all practical purposes.

When it was realized that we were in the midst of a streptococcal epidemic cultures were taken from within the vaginal orifice of every

TABLE III. CASES WITH STREPTOCOCCUS HEMOLYTICUS IN BLOOD SHOWING DAY POSTPARTUM ON WHICH FIRST POSITIVE CULTURE WAS OBTAINED, THE RESULT AND AUTOPSY FINDINGS\*

NAME	FIRST POSITIVE CULTURE	RESULT	AUTOPSY FINDINGS
Mrs. M.	None	Died on 75 day	Multiple abscesses throughout abdomen. Definite evidence of lymphatic spread
Mrs. T.	8 day	Died on 9 day	Diffuse peritonitis
Mrs. N.	None	Died on 5 day	Lymphangitic pneumonia
Mrs. J.	10 day	Died on 13 day	Partial autopsy
Mrs. B.	2 day	Died on 3 day	Diffuse peritonitis
			Diffuse peritonitis
			Lymphatic spread in broad ligaments
Mrs. L.	11 day	Died on 17 day	Diffuse peritonitis
Mrs. C.	None taken	Died on 3 day	No autopsy
Mrs. McG.	18 day	Died on 20 day.	No autopsy
		Had a pleurisy with streptococci	
Mrs. R.	26 day (one single colony)	Discharged on 52 day	
		Had pelvic cellulitis	
Mrs. F.	4 day	Died on 17 day	No autopsy

\*Hemolytic streptococcus recovered from peritoneal cavity in all of above autopsied cases.

patient before delivery, immediately after delivery, and on the second, fourth, and seventh days of the puerperium. In no case did we find a hemolytic streptococcus before delivery but from three a hemolytic streptococcus was obtained on the second day of the puerperium. These patients were isolated. Two of them had afebrile puerperium. The culture from one of these was still positive on discharge from the hospital. The third, Mrs. M., after being afebrile for five days had a sudden rise of temperature with a chill, and after a long illness died on the seventy-fifth day. These cases are of interest and importance as showing that the organisms entered into the vagina during or immediately after delivery, that organisms may be present in the vagina and never infect the uterus, and that if the uterus is invaded three days may elapse before symptoms develop. No previous vaginal cultures had been

taken from the two patients who began their infection on the eighth and ninth day postpartum, these cases having occurred before the routine was begun.

*Autopsy Findings.*—In three of the fatal cases no autopsy examination was permitted; in three the abdomen only was examined; and in three a complete autopsy was made. In all the cases examined peritonitis with free fluid was found. In all there was fibrinous exudate on the intestines. In one there were multiple abscesses in the peritoneal cavity and cellular tissue of the pelvis.

In none was there any evidence of septic thrombophlebitis of the pelvic veins.

In the cases examined fully there was definite evidence of lymphatic spread of the infection in the form of lymphatic vessels choked with polymorphonuclears and organisms; leucocytic infiltration of blood vessel walls; abscess formation in the uterine wall, in the ovaries, and in the cellular tissue of the pelvis; interstitial lymphatic pneumonia, and pleurisy.

These findings together with certain clinical phenomena already mentioned point to a primary lymphatic rather than a blood borne infection.

#### TREATMENT

In the treatment of this series of cases of streptococcal puerperal infection three main therapeutic agents were used, viz.: antistreptococcal serum, quinine bi-hydrochloride, and blood transfusion. In most cases a combination of two or of all three was used. Thus five cases, two fatal and three nonfatal, had all three; three, two fatal and one nonfatal, had transfusion and serum; eight, two fatal and six nonfatal, had serum and quinine bi-hydrochloride. (Table IV.)

*Antistreptococcal Serum.*—This was used in eighteen cases, six of which proved fatal and twelve of which recovered. Five of the fatal cases had a positive blood culture, and eleven of the nonfatal cases a negative culture; the twelfth case showing one colony of streptococci on the plate on one occasion only, late in the disease.

Two types of serum were used, one a polyvalent Lederle serum which was given as a rule in 100 c.c. doses intravenously. The other was a special concentrated serum of Parke Davis and Company, of which 10 c.c. is said to be equal to 100 c.c. of their serum as formerly prepared. This was given as a rule in 10 c.c. doses intravenously. Five patients were given 20 c.c. doses with no untoward result. Other deviations from the general dosage mentioned for both sera will be seen in Table IV. One patient had a 10 c.c. dose of Dohet serum. Three patients showed a marked reaction, two of them during the administration of the Lederle product so that it had to be stopped and one, a late reaction after the concentrated serum. All the others stood it well. The concentrated serum was given to ten patients with three deaths; the ordinary serum to six patients with two deaths. The ordinary and concentrated were both given to one patient who recovered, and the concentrated Dohet serum to one, who recovered.

The first dose of serum was given immediately on the rise of temperature in two cases, on the second day, i.e., within twenty-four hours, in eight cases, and on the

third day in six, on the fourth day in one case, and on the fifth day in one. Ten patients had one dose only, one of these died and nine recovered. Eight patients had two doses, two of these died and six recovered. One fatal case had three doses.

Only two patients had serum as their only treatment. It was given on the second day in each case. Both made rapid recoveries and were discharged, one on the fifteenth day and the other on the seventeenth day postpartum. In two cases transfusion was given along with serum treatment. One patient died and the other recovered.

*Antistreptococcal Serum and Quinine Bi-Hydrochloride.*—In thirteen cases serum was given in combination with quinine bi-hydrochloride administered intramuscularly in five grain doses. The preparation used was one put up in sterile ampules and it was injected deep into the muscle of the thigh or buttock. This combination of serum and quinine bi-hydrochloride was first brought to our attention by Luker who reported good results which we had confirmed. His routine was the administration of 30 c.c. of antistreptococcal serum on three successive days, and, after that, five grains of quinine bi-hydrochloride in 10 c.c. of sterile distilled water intravenously on the fourth, sixth, and eighth days; 5 grains of quinine bi-hydrochloride in 1 c.c. of water are given intramuscularly on the fifth, seventh, ninth, tenth, eleventh, and twelfth days. By this treatment he has reduced the mortality from 34.2 per cent to 5.6 per cent. Luker believes that the action of quinine bi-hydrochloride in those cases is a general one on the tissue cells.

This precise routine we did not follow. From Table V it will be seen that the quinine was given on the first day of temperature rise in eight cases, on the second day in four, and on the fifth day in two, and that when repeated it was usually, but not always, on alternate days with the serum. Of the thirteen patients treated in this way four died and nine recovered. Late transfusions were given in two of the fatal, and in three of the nonfatal cases. In two patients abscesses at the site of quinine bi-hydrochloride injection developed and from the pus a hemolytic streptococcus was recovered in each case. We have had a similar occurrence in two other cases treated elsewhere.

*Blood Transfusion.*—In this series of cases blood transfusion was given to eleven patients (Table VI). The direct method was used in four, and the citrate method in seven. The reason why the citrate method was used in the majority of cases was that the transfusion had to be done in the septic wards and it was thought that the donor would be exposed to a definite risk if the direct method were employed. In considering blood transfusion in puerperal septicemia two different aspects of the procedure have to be kept in mind, first, blood transfusions early in the disease as a possible means of increasing the patient's resistance to the invading organisms and their toxins, and secondly, as a supportive measure in long drawn out cases. At the beginning of the epidemic we were relying on the serum and quinine bi-hydrochloride treatment as already outlined because we had had as good results with it as with any other method of treatment in the past, but some of our patients had early transfusions. Five patients were transfused within the first four days of their illness, one on the first day, one on the second and sixth days, one on the second day, one on the third, fifth, and seventh days, and one on the fourth and ninth days. Of these five patients the first two mentioned died and the three others recovered. The two who died had positive blood cultures; the three who recovered had negative blood cultures. One of those who died had a direct, and one, a citrate transfusion. It is interesting to note that in all three who recovered there was a definitely localized pelvic inflammation in the latter part of the disease. Whether this localization can be attributed to the transfusion or indicates a limitation of the infection from the start it is impossible to say.

TABLE IV. TREATMENT

NAME	BLOOD CULTURE	TRANSFUSION		SERUM		QUININE DAY OF DISEASE AND AMOUNT	REMARKS	RESULT
		DAY OF DISEASE AND AMOUNT	METHOD	DAY OF DISEASE AND AMOUNT	SERUM TYPE OF			
Mrs. B. Mrs. J.	Positive	1st—600 c.c.	Direct Citrate	3rd—150 c.c.	Lederle		Normal delivery	Died on 3rd day
	Positive	2nd—600 c.c. 6th—500 c.c.		2nd—20 c.c. 4th—20 c.c.	P. D. conc.	1st—5 gr.	Cesarean section	Died on 13th day
Mrs. McG. Mrs. L.	Positive		Citrate	5th—90 c.c. 9th—175 c.c. 14th—210 c.c.	Lederle	2nd—5 gr. 3rd—5 gr. 11th—5 gr. 12th—5 gr.	Normal delivery	Died on 20th day
	Positive	12th—250 c.c.					Normal delivery	Died on 17th day
Mrs. M. Mrs. T.	Negative	8th—450 c.c. 24th—500 c.c. 55th—500 c.c.	Citrate	1st—20 c.c. 4th—20 c.c.	P. D. conc.	1st—5 gr. 2nd—5 gr.	Peritoneal abscess	Died on 75th day
	Positive			3rd—20 c.c. 4th—20 c.c.	P. D. conc.	1st—5 gr. 2nd—5 gr. 4th—5 gr.		Died on 9th day
Mrs. F. Mrs. C.	Positive	10th—500 c.c.	Direct	8th—20 c.c. 10th—10 c.c.			Acute mania	Died on 17th day
	Not taken						Clinical diagnosis of pneumonia following Cesarean section	Died on 3rd day
Mrs. N. Mrs. F.	Positive		Direct	3rd—100 c.c.	Lederle		Cesarean section markedly distended	Died on 5th day
	Negative	2nd—600 c.c. 6th—500 c.c. 3rd—500 c.c.					Pelvic abscess	Discharged 40th day
Mrs. B. Mrs. B.	Negative	5th—600 c.c. 7th—500 c.c. 29th—500 c.c. 31st—500 c.c.	Direct				Pelvic cellulitis	Discharged 56th day
	Negative							

TABLE IV—CONT'D

NAME	BLOOD CULTURE	TRANSFUSION		SERUM		QUININE DAY OF DISEASE AND AMOUNT	REMARKS	RESULT
		DAY OF DISEASE AND AMOUNT	METHOD	DAY OF DISEASE AND AMOUNT	TYPE OF SERUM			
Mrs. R.	One colony on one occasion	4th—500 c.c. 9th—500 c.c. 14th—150 c.c. 24th—300 c.c.	Citrate	2nd—10 c.c.	Lederle	1st—5 gr. 3rd—5 gr.	Marked reaction after 10 c.c. given	Discharged 51st day
Mrs. C.	Negative	5th—150 c.c. 10th—450 c.c. 17th—500 c.c.	Citrate	1st—10 c.c. 5th—10 c.c.	P. D. conc.	5th—5 gr.	Pelvic abscess marked late serum reaction	Discharged 57th day
Mrs. S.	Negative	14th—500 c.c.	Citrate	2nd—20 c.c. 4th—10 c.c.	P. D. conc. Dochet	1st—5 gr. 3rd—5 gr. 2nd—5 gr. 3rd—5 gr.	Cesarean section	Discharged 24th day
Mrs. P.	Negative	29th—100 c.c.	Citrate			5th—5 gr. 5th—5 gr. 8th—5 gr. 10th—5 gr.	Trouble with donor	Discharged 51st day
Mrs. E.	Negative			9th—20 c.c. 11th—10 c.c.	P. D. conc.	5th—5 gr. 10th—5 gr.	Streptococcal abscess at site of quinine injection	Discharged 26th day
Mrs. W.	Negative			2nd—100 c.c. 5th—10 c.c.	Lederle P. D. conc.	1st—5 gr. 2nd—5 gr.		Discharged 18th day
Mrs. D.	Negative			2nd—40 c.c. 4th—10 c.c.	Lederle	4th—5 gr. 1st—5 gr.	Marked reaction after 40 c.c. serum given	Discharged 13th day
Mrs. L.	Negative			3rd—10 c.c.	P. D. conc.	1st—5 gr.		Discharged 22nd day
Mrs. S.	Negative			2nd—10 c.c.	P. D. conc.	2nd—5 gr.		Discharged 16th day
Mrs. F.	Negative			2nd—10 c.c.	P. D. conc.	2nd—5 gr. 4th—5 gr. 5th—5 gr.	Had diabetes	Discharged 23rd day
Mrs. C.	Negative			2nd—20 c.c.	P. D. conc.			Discharged 15th day
Mrs. B.	Negative			2nd—10 c.c.	P. D. conc.			Discharged 17th day
Mrs. S.	Negative						Only medicine was "cholera mixture"	Discharged 20th day



TABLE V. CASES TREATED WITH QUININE AND ANTISTREPTOCOCCAL SERUM

NAME	QUININE DAY ON WHICH GIVEN	SERUM DAY OF DISEASE	OTHER TREATMENT	RESULT
Mrs. McG.	1	2, 4		Death 20th day post-partum
Mrs. L.	2, 3, 11, 12	5, 9, 14	Transfusion on 12th day	Death 17th day post-partum
Mrs. M.	1, 2	1, 4	Transfusions 8th, 24th, and 55th days	Death 77th day post-partum
Mrs. T.	1, 2, 4	3, 4		Death 9th day post-partum
Mrs. R.	1, 3	2	Transfusions 4th, 9th, 14th, 24th	Discharged on 51st day postpartum
Mrs. C.	5	1, 5	Transfused 5th, 10th, and 17th	Discharged on 57th day postpartum
Mrs. S.	1, 3	2, 4	Transfused 14th day	Discharged on 24th day postpartum
Mrs. E.	5, 8, 10	9, 11		Discharged on 26th day postpartum
Mrs. W.	1, 2, 4	2, 5		Discharged on 18th day postpartum
Mrs. D.	1	2		Discharged on 13th day postpartum
Mrs. L.	1	4		Discharged on 22nd day postpartum
Mrs. S.	2	3		Discharged on 16th day postpartum
Mrs. F.	2, 4, 5	2		Discharged on 23rd day postpartum

Transfusion treatment was begun in six cases after the fourth day of the illness and was repeated in two, who had been transfused earlier. Of these six patients three died and three recovered. We were influenced to a certain extent in our choice of transfusion by the fall of hemoglobin early or late in the disease. In Table II it will be noted that in the cases transfused there had been an average drop of 19 per cent in the hemoglobin before transfusion and an average recovery of 6.6 per cent after it. In the cases which were not transfused the average drop in hemoglobin was only 7.25 per cent but there was no rise during the patients' stay in the hospital.

*Summary of Treatment.*—The results of the three methods of treatment are summarized in Table VII. From this it would appear that the best results had been obtained by serum and quinine bi-hydrochloride, the next best by no treatment at all, and the worst by transfusion. These figures are of course fallacious. Our first treatment in the majority of cases was serum and quinine bi-hydrochloride. A considerable number of patients showed immediate improvement and no other treatment was given. Had our initial treatment been transfusion no doubt equally good results would have been got and the recoveries ascribed to serum and quinine bi-hydrochloride would have gone to the credit of transfusion. Which bears out what has been so often said before, that it is impossible to assess accurately the value of any one method of therapeutics in puerperal sepsis, because a considerable number of patients recover without any treatment and a certain number will die in spite of whatever treatment is used. In this connection a little interlude in the somber story already told may be introduced. One of the attending surgeons refused to believe that one of his private patients, Mrs. S., had the disease in spite of a high temperature with chills and leucocytosis. She had marked abdominal distention with diarrhea and the only treatment she had was

TABLE VI. CASES TREATED BY TRANSFUSION

NAME	DAY OF FEVER ON WHICH DONE AND AMOUNT OF BLOOD GIVEN	METHOD	OTHER TREATMENT	REMARKS	RESULT
Mrs. B.	1st—600 c.c.	Direct		Streptococci in blood	Died on 3rd day postpartum
Mrs. J.	2nd—600 c.c.	Citrate	Serum	Streptococci in blood	Died on 13th day postpartum
Mrs. M.	6th—500 c.c. 8th—450 c.c. 24th—500 c.c. 55th—500 c.c.	Citrate	Serum and quinine	Blood sterile	Died on 75th day postpartum
Mrs. L.	12th—250 c.c.	Citrate	Serum and quinine	Streptococci in blood	Died on 17th day postpartum
Mrs. F.	10th—500 c.c.	Direct	Serum	Streptococci in blood	Died on 17th day postpartum
Mrs. F.	2nd—500 c.c.	Direct	Serum	Blood sterile	Recovery Discharged on 40th day postpartum
Mrs. B.	3rd—500 c.c. 5th—600 c.c. 7th—500 c.c. 29th—500 c.c. 31st—500 c.c.	Direct		Blood sterile Before the second transfusion 300 c.c. of blood was withdrawn	Recovery Discharged on 56th day postpartum
Mrs. R.	4th—500 c.c. 9th—550 c.c. 14th—150 c.c. 24th—500 c.c.	Citrate	Serum and quinine	Blood sterile	Recovery Discharged on 51st day postpartum
Mrs. C.	5th—150 c.c. 10th—450 c.c. 17th—500 c.c.	Citrate	Serum and quinine	Blood sterile In first transfusion hematoma formed round the vein	Recovery Discharged on 57th day postpartum
Mrs. S.	14th—500 c.c.	Citrate	Serum and quinine	Blood sterile	Recovery Discharged 24th day postpartum
Mrs. P.	29th—100 c.c.	Citrate		Blood sterile Trouble with donor	Recovery Discharged on 51st day postpartum

TABLE VII. ANALYSIS OF RESULTS OF TREATMENT

	NUMBER	RECOVERED	DIED	MORTALITY PER CENT
Early Transfusion	4	2	2	50
Early Transfusion + Serum + Quinine	1	1	0	0
Late Transfusion	2	1	1	50
Serum + Quinine	8	6	2	25
Serum + Quinine + Late Transfusion	4	2	2	50
No Transfusion or Serum or Quinine	5	3	2	40
Total	24	15	9	37.5

something known as "sun cholera mixture." She made a rapid and complete recovery. The recovery of the diabetic patient is also noteworthy.

The startling thing in this series of cases is that every patient with a positive blood culture died with one exception, Mrs. R., from whom one colony was ob-

tained on one occasion late in her disease and who ultimately recovered. This high mortality is exceptional as we have all seen cases with positive blood culture recover. The rather late appearance of the positive blood culture in most of the cases and the postmortem evidence of a lymphatic spread may indicate that these patients were saturated with toxins long before blood infection occurred and that the latter was really a terminal phenomenon.

And so from this series of cases it is impossible to dogmatize about treatment, but we can give our impressions and outline a possible method of procedure in dealing with cases of fever in the puerperium. Our impression is that in a hemolytic streptococcal infection blood transfusion done early and repeated on alternate days is as good a form of treatment as any available. It counteracts the fall in hemoglobin and, apparently, in many instances acts as a nonspecific agent in increasing the resistance of the tissue cells to the infection. But many cases of puerperal sepsis occur in domestic practice where early transfusion may not be possible, and there are many cases of fever in the puerperium which subside rapidly, for which no cause is ever found, and in which immediate transfusion would certainly be out of place. For these reasons the following outline scheme of treatment is given, the details to be varied according to circumstances. On the first rise of temperature give five grains of quinine bi-hydrochloride intramuscularly. In many cases the temperature will be found to be normal or nearly normal next day, in which case no further treatment may be required. If temperature and pulse are still high after twelve or twenty-four hours, serum may be given intravenously, the dose being the equivalent of 100 c.c. This may be repeated in twelve hours. Meantime, provision for transfusion should be made. If there is a marked drop in hemoglobin, transfusion is more strongly indicated and should be done on alternate days, no more serum being given but the quinine bi-hydrochloride continued. If the patient shows definite improvement after serum and quinine bi-hydrochloride alone and there is no marked fall in hemoglobin, transfusion may not be required at all. If the case is a long drawn out one, transfusion in the later stages materially helps convalescence.

In our present state of knowledge we have no specific treatment for streptococcal puerperal infection. All three therapeutic measures discussed are nonspecific agents which in some cases seem to have a definite action in increasing the patients' resistance but in a certain number they either do not do this or the virulence of the invading organism is such that all the resistance called forth is unavailing.

#### SUMMARY AND CONCLUSIONS

1. During the period January 16, to February 14, 1927, twenty-four patients, out of a total of one hundred and sixty-three delivered, developed streptococcal infection and eight of them died. One other died later. One baby died of erysipelas. One nurse got a severe streptococcal infection of the arm and recovered. One nurse developed a primary streptococcal peritonitis and recovered after laparotomy.

2. Cases continued to occur after treatment of the operating and delivery rooms with chloride of lime; after a change was made to a delivery room which had never been used before; and they only ceased when admissions to the hospital were stopped.

3. A complete bacteriologic investigation of the hospital failed to demonstrate hemolytic streptococci in the air, on the floors or walls, in the operating rooms, in dressings, supplies, or water.

4. The only place where streptococci were found, other than in the infected patients, was in the nose and throat of certain doctors, nurses, and members of the domestic staff.

5. The exclusion of these carriers from direct contact with patients failed to arrest the epidemic. This may have been because fresh carriers were always being discovered.

6. Masking of the nose and mouth of all in attendance on patients before, during, and after labor failed to arrest the epidemic.

7. Notwithstanding the above, the fact that streptococci were demonstrated in no situation other than the nose and throat of attendants makes it important to exclude streptococcal carriers from maternity hospitals and to insist on complete masking by all in attendance on parturient or puerperal women.

8. The data available are not sufficient to determine whether one or more of these carriers brought the infection in, in the first instance, or whether they picked up the organism from the infected cases. The latter is possibly true in some cases.

9. The occurrence of a primary peritonitis in a nurse shows that there may be points of entry for the hemolytic streptococcus other than the vagina and puerperal uterus, but the finding of the organism in the vagina of nearly all infected patients shows that this was the common portal.

10. The particular streptococcus in this series of infections was a very virulent one.

11. Every patient but one with a positive blood culture died.

12. The late appearance of streptococci in the blood of most of the cases and the postmortem findings point to a lymphatic dissemination.

49 EAST FIFTY-THIRD STREET.

(For discussion, see page 286.)

# EPIDEMIOLOGIC AND BACTERIOLOGIC INVESTIGATION OF THE SLOANE HOSPITAL EPIDEMIC OF HEMOLYTIC STREPTOCOCCUS PUERPERAL FEVER IN 1927

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IN THESE days of aseptic precautions, a large epidemic of puerperal fever is an unusual event. Sporadic cases and small groups of cases occur from time to time in every obstetric hospital but there are probably very few living today who have been through an experience such as Dr. Watson has described. And yet, there is not one who cannot imagine himself in that situation and has not speculated what he would do to check such an epidemic if it were to occur in his own hospital. For if it occurred in one well-organized and well-run hospital, it is likely to occur in any hospital under the same or similar circumstances.

Let it be stated at the outset, however disappointing that information may be, that our study of the situation has not given us the knowledge necessary to prevent epidemics of puerperal fever, but we believe that we have derived some facts which give us a better understanding of the nature of such epidemics, which will permit us to minimize the risk of a recurrence and which would enable us to check another such epidemic in an earlier stage than this one was checked. The purpose of this report is to pass on our results for what they are worth and to add them to the literature so that they may be available to others who may be interested. We shall frankly confess our mistakes and our shortcomings and these were many. We fell far short of learning all there was to learn, particularly in the early stages of the epidemic, the steps of which we can only surmise from the facts obtained later.

A review of the literature from the classic essay of Oliver Wendell Holmes<sup>1</sup> and circumstantial evidence of etiology by Semmelweis<sup>2</sup> give the impression that in their time it was acknowledged by unprejudiced observers that the doctors and midwives were the chief agents in spreading the disease, but some years later after the application of aseptic principles, it was supposed that they were thereby absolved from further responsibility in the matter. The more recent literature is filled with studies of sporadic cases in given clinics over varying periods of time. There are very few reports of real epidemics and in these there is a paucity of information about the preepidemic or early epidemic stages.<sup>3</sup> An epidemic is always several days or several weeks old be-

fore it can be called an epidemic. It is only the constant repetition of similar cases that makes one aware of its presence.

Dr. Watson has described the repetition of events which led him and his staff to realize that an epidemic of a very virulent nature was in full swing. He called for help from a number of sources. When these had responded and held council with his staff, the situation was studied in detail. It should be pointed out that no one in the group had ever faced a similar situation before. A number of surveys were made of the physical plant and the methods used in caring for the patients from the time they entered until they were discharged. As a result of the survey these facts were evident:

1. *The technic of admitting and delivering patients had not been radically changed.*—Five or six patients were admitted daily, given a preliminary vaginal examination, and if not in labor sent to the wards. Before delivery they were prepared by shaving with a razor and washing with soap and water and alcohol. During the first stage of labor vaginal examinations were avoided if possible. For vaginal examinations rubber gloves were used by the examiners but no masks were worn. During the second stage of labor the external parts were again washed with soap and water and painted with 3½ per cent iodine. A sterile towel was placed over the delivery table beneath the buttocks and sterile sheets over the thighs and abdomen. The vagina and anterior part of the anus were exposed. The doctors and nurses wore gowns, gloves, caps, and masks which covered the mouth but not the nose. After delivery the vagina was covered with a sterile pad held by safety pins to a circular binder. If a perineal tear had occurred, sterile pads were placed beneath the buttocks and not over the vulva. On return to the wards these sterile pads were changed every four hours or oftener if they became soiled. The nurses caring for the postpartum cases were not masked.

2. *The comings and goings of staff members, nurses in training, and visitors had not been materially altered.*—Aside from the attending and house staff, from 14 to 26 nurses came each month from seven other hospitals for three months of training. Visitors consisting of husbands and mothers were admitted three times a week to the wards and more often to the semiprivate and private rooms.

3. *The preparation and distribution of sterile and clean operating room and laundry supplies had not been modified.*—Gloves, towels, vulva pads, sponges, and compresses were prepared in two different autoclaves, under the direction of an experienced nurse. Sterilization was controlled by pressure gauges and thermometer recorders. Solutions were sterilized in a general autoclave. Sterile water was prepared in several different water sterilizers. Sheets and clean towels were delivered daily from the laundry. Soiled linen from cases on individual precautions was sterilized by soaking in lysol and then boiling.

4. *The serving of food and the care of trays had not been altered.*—Food was brought up to the ward pantries from the kitchen in large containers, distributed to the individual trays and kept warm in steam wagons in transit to the wards. Trays and dishes from patients on "individual precautions" were sterilized after use. Bed pans were all sterilized after use in steam bed pan sterilizers. After use by patients "on individual precautions," bed pans were soaked in 5 per cent lysol until used again.

5. *The delivery rooms were distributed as follows:*—(a) One was on the ground floor with windows opening on a delivery and automobile parking court. This had several rows of benches for students' clinics separated from the main part

of the room by a railing. (b) Another was on the third floor with windows opening on an ell of the same court, somewhat more protected. These two rooms were ventilated by a current of air driven up from the cellar by a fan and opening near the floor. These ventilators were not protected by filters. (c) The gynecologic operating room where the cesarean sections were performed was on the seventh floor with windows opening above a court.

6. *A scrutiny of the individual cases as they appeared brought out some interesting facts from an epidemiologic viewpoint.*—The fatal and seriously ill cases apparently had only one thing in common, namely childbirth with its inevitable vaginal exposure to trauma and contamination. Some were primipara, others were multipara. Some had normal positions and others abnormal ones. Most had intact membranes on admission, a few had ruptured membranes. Some had spontaneous labor, others required the use of instruments, and still others had cesarean section performed. They were delivered in three different operating rooms and there was no single member of the staff present at all deliveries. The postpartum course was strikingly similar in all of the cases. After delivery the course was normal for the first two or three days and then suddenly the presence of an infection was announced by a rise to 104° or 105° F. Thereafter in most cases the patient's course was stormy. The first fatal case died forty-eight hours after the temperature rise with what appeared to be fulminating pneumonia. No cultures were taken and no autopsy was performed. The second fatal case died suddenly with peritoneal symptoms four days after the temperature had risen. In this instance no cultures were taken before death, but at the autopsy a peritonitis was found and smears showed gram-positive cocci and gram-negative bacilli. The cocci could not be recovered from the contaminated culture. The third fatal case had definite peritonitis and cultures were obtained at autopsy. These were at first reported to contain a pneumococcus but further examination revealed the organism to be hemolytic streptococcus. In all subsequent cases the organism was frankly recognized as a hemolytic streptococcus, and when the staff and advisors met to consider the situation, it was recognized by all that they were dealing with an epidemic of puerperal fever caused by the hemolytic streptococcus.

This led to a consideration of the following questions:

A. *Where did the organism come from?* Was it brought in by the patients, by staff members, by visitors, in the food or in the dust from the street?

B. *Where is the organism now?* Is it in the sick patients only? Is it being carried by well patients? Is it being carried by one or more ill or one or more well staff members? Is it in the delivery rooms, operating rooms, the wards, in the "sterile" solutions and supplies, or in the laundry?

C. *When did the organism get into the patients?* Did it enter before admission; at the first vaginal examination; during the first, second, or third stages of labor; after the delivery of the placenta; or when the patients were in the wards after delivery?

D. *How did the organism get into the patients?* By the vagina, on the hands of the examiners, on the instruments or solutions used in shaving, on the hands of the operators, from towels, pads on the operat-

ing table beneath the patients, from anal discharges? Or did it enter through the nose or mouth?

E. *What is the nature of the organism?* Is it a single strain or does each case represent a different strain? Has it a special affinity for the vagina and uterus? Will it grow elsewhere? Is it multiplying in the hospital?

It was obvious at once that to attempt to answer all of these questions would require a considerable amount of work in bacteriology. This the laboratory of the hospital, already taxed to capacity with routine duties, was unable to do. At the earnest solicitation of Dr. Watson and at the direction of Dean Darrach and Dr. Whipple, Professor of Surgery, the bacteriologic section of the Surgical Research Laboratories was given over to this work because one of us had recently made a successful study of a small epidemic of hemolytic streptococcus wound infections following operation in the surgical service of the Presbyterian Hospital.<sup>3</sup> Our own problems were temporarily suspended because of the urgency of the situation, but some days passed before the work could be organized and the necessary technical help procured. The first bacteriologic survey of the hospital was begun just eighteen days after the delivery of the first sick patient of the series. These facts are mentioned not as an excuse for our failure to find out more than we did about this epidemic but to stress the need, as we shall do later, for a running organization immediately available for the study of such cases as they arise, if a satisfactory study is to be made and results of paramount importance are to be obtained.

#### THE SCOPE OF THE PROBLEM

A. We attacked the problem by attempting to answer the questions enumerated above. The first question, "*Where did the organism come from?*" could not, of course, be answered definitely because of the progress which the epidemic had already made, but some light might be thrown upon it by a general consideration of the biologic relationships of this bacterium. The hemolytic streptococcus is a very extensively distributed organism. It is always active and particularly conspicuous as a cause of disease in the late winter and early spring months in temperate climates and all through an "open" winter with changeable temperature as the winter of 1927 was. The organisms occur not only in the nose and throats of persons suffering from colds and sore throats, but in the nasopharynx of normal persons who may come in contact with them. Certain people carry them for months in the crypts of tonsils.<sup>4</sup> Others pick them up and carry them for a few days or a few weeks only. Hemolytic streptococci multiply readily in the human nose and throat and persons who are carrying them in these places are constantly discharging them when coughing or sneezing and even during speaking and breathing. It has been demonstrated that during an operation, a wound may be contaminated by, and an infection result from, an organism discharged upon the sterile field from the unmasked nose of one of the operating staff.<sup>5</sup> When streptococci are growing in the nose or throat, many are swallowed and while most of these are killed in the stomach, a few may be carried through the intestines and be discharged in the feces.<sup>6</sup> From the nose and mouth, streptococci



are transferred to handkerchiefs and hands and by the hands to other objects. A "sterile" field may be contaminated if masks are not worn by the attendants, and the organism may be transferred from one object to another. When outside the body, hemolytic streptococci die off rapidly, particularly if exposed to sunlight but they may live in the cold under artificial conditions, when completely dried, for a number of years. The transfer from person to person may be directly from mouth to mouth or by contact of hands or objects touched by the hands.

Streptococci occur normally in the vagina but the hemolytic varieties are relatively rare even in pregnant women. Of course, streptococci in the nose or throat or vagina are on the physiologic exterior of the body. They do not cause disease unless they penetrate into the interior. There must be a combination of factors operating to bring this about. Certain of these factors are well recognized while others are little understood. Human beings vary considerably in their susceptibility to invasion. Among the variable factors in the host are: the presence or absence of an actual break in or an injury to the surface cells; an altered physiologic state such as the congestion or the excessive exudation of surface secretions; local tissue immunity or hypersusceptibility; general cellular or humoral immunity or hypersusceptibility; variations in general resistance accompanying chilling, starvation or wasting diseases. Likewise different strains of hemolytic streptococci vary and the same strain at different times varies considerably in its invasive properties. Aside from the factors of the number of organisms inoculated and the site of inoculation, there are the factors of diffusible toxins, digestive ferments, capsule formation, and the nature of and the immediacy of transfer from the immediately preceding environment of the bacteria. Experimentally we can increase the invasive properties of certain strains of hemolytic streptococci by injecting lethal doses from one to another of a given species of animals. Often as the virulence increases for one species it decreases for another. There is, therefore, no correlation possible between man and animals by which the virulence of a given organism may be tested at any given time. In some instances the virulence may be enhanced rapidly by a few animal passages, in others it requires many passages and in others the virulence cannot be enhanced at all.

To account for sporadic cases of puerperal sepsis, the factors operating in the host are probably just as important as the factors inherent in the organism. To account for an epidemic of such proportions as this one, it is more logical to look for the chief factors in the invading organism. Here we were probably dealing with an average group of women, varying from each other in susceptibility but as a group not unusually susceptible. There was probably introduced among them an organism of great invasive properties for human beings. The supposition is that it had increased its virulence by frequent passages through human beings. This may have occurred by passing the organism from mouth to mouth until its progeny in succeeding generations found it easy to grow in the environment of human tissues even when introduced in relatively small numbers. It is not likely that this could have been accomplished by passing through a series of normal throats without invading the tissues but it is quite likely that this could have been accomplished by passing through a series of throats if in some of them it had actually invaded the tissues and had overcome to some degree the local resistance of those tissues. There is always the possibility that some unknown factor, a symbiotic organism for instance, entered the situation and increased the virulence of the streptococcus to an unusual degree in a very short time. It may have come fairly directly from any fatal human infection, even from a case of puerperal sepsis. It is not necessary to assume

any specific affinity of this organism for uterine tissue. In parturient women, the large denuded and ragged inner surface of the uterus is, for a few days at least, a fruitful field for the growth of any virulent organisms which may be planted there. It would seem to be a better field than the perineal tissues of a gynecologic operation or the relatively normal peritoneum exposed during a laparotomy. It simulates more closely the ragged lacerated tissues of a gunshot wound of soft parts.

In the days of Holmes and of Semmelweis, epidemics of puerperal fever were common events. There seems to be no room for doubt that there was direct transfer by the hands in some of these cases but where intervals occurred between cases, as in the experience of certain country practicing obstetricians, the supposition is that they carried the organisms in a place where they could grow, such as the nose and throat, and that the contamination of the hands immediately preceded the introduction of the organisms into the vagina of the patients. When hands were carefully washed epidemics diminished. Later when gloves were worn and sterile instruments and supplies were used the epidemics were still further reduced in number. In the present situation, we had to assume that the epidemic was caused by the coincidence of a number of factors. In order to attack it, the obvious course was to attempt to prevent the operation of any of the factors which we might find to be at work.

With these ideas in mind, as a basis for immediate action, the theory was tentatively held that the organism was being introduced into the vagina of the patients by members of the hospital staff either just before, during, or just after delivery, and that it was being carried by one or more members of the staff in the nose and throat. Inasmuch as masks were not worn at all by the doctors during the preliminary examinations, and because of the fact that during the delivery process the mouths of the attendants were masked but not the noses, and in the wards after delivery the nurses were not masked, it was suggested that rigidly complete masking be practiced, that antepartum examinations be dispensed with, that more extensive preparation of the operative field be carried out and that an attempt be made to find out what members of the staff were carrying the hemolytic streptococcus.

B. In an attempt to answer the question "*Where is the organism now?*" cultures were made extensively throughout the hospital. This bacteriologic survey was not accomplished all at once. Cultures were taken in the order of their apparent importance at the time. First vaginal cultures of patients with fever, then nose and throat cultures of the staff, then the air and objects in the operating rooms and wards, then the supplies and solutions, then the nose and throat cultures of the sick patients and lastly vaginal as well as nose and throat cultures of all of the patients. As stated above, the first extensive bacteriologic survey was begun just eighteen days after the delivery of the first case in this series. In the meanwhile a large group of nurses and one of the doctors had left the hospital.

The cultures were made directly on 5 per cent sheep's blood agar plates. Vaginal cultures from the patients revealed hemolytic streptococci greatly predominating and sometimes in pure culture in all but one of the patients showing the typical symptoms of puerperal fever. The explanation of the failure to find it in this case is not apparent. Three other patients also yielded hemolytic streptococci from the vagina and one of these, three days later, entered into the typical symptoms of the malady, while the other two remained well. Inasmuch as, at first, vaginal cultures were only taken on patients with a fever, all of which were postpartum, it came about that in no case of puerperal fever was an antepartum vaginal culture taken, so that we could not tell from the cultures alone

whether or not these patients were bringing the organism into the hospital. It so happened that when routine antepartum cultures were taken not one was found to yield a hemolytic streptococcus in about 170 examinations.

Cultures from the nose and throat of ten of the ill patients yielded no hemolytic streptococcus. The others were not examined. Of 31 patients without puerperal fever, one carried hemolytic streptococcus in the throat.

In order to have some idea of the distribution of the organism by the sick patients, cultures were made from the bed sheets and thighs of four of the patients with positive vaginal cultures, two of them with and two of them without symptoms of puerperal fever. Curiously enough the two who were ill yielded no organisms either on their thighs or beds. This may have been due to their more careful isolation. Of the other two, hemolytic streptococci were found on the bed and on the thighs of one but only on the bed of the other. The stools of three of the patients were examined but yielded no hemolytic streptococci.

Cultures from the nose and throat of the professional staff revealed many carriers of hemolytic streptococci. The figures are shown in Table I. The difference between the nursing staff and students as compared with the other persons including the doctors, the administrative staff, and the patients, is very striking. Subsequent cultures on the positive cases showed that some of these were transient and some were chronic carriers. Treatment with antiseptic sprays and washes was carried out vigorously to minimize, if possible, the number of bacteria discharged by the carriers. This was probably responsible for a certain number of negative cultures, but whether it markedly affected the carrying state of the chronic carriers is questionable. All incoming nurses were cultured upon their arrival. The respective hospitals from which they came were later directed to culture them before departure and send no carriers of hemolytic streptococci.

TABLE I. HOSPITAL PERSONNEL AND PATIENTS YIELDING HEMOLYTIC STREPTOCOCCI FROM NOSE AND THROAT CULTURES IN THE MONTH OF FEBRUARY, 1927

	NURSES	DOCTORS	STUDENTS	NONPROFES- SIONAL STAFF	PATIENTS
Total number examined	100	26	12	60	41†
Number positive throat cultures	18	2	2	2	1‡
Number positive nose cultures	6	1	1	1	1
Number of positive carriers	20*	2†	3	3	2
Percentage of carriers	20	8	25	5	4

\*Four of these yielded organisms from both the nose and the throat.

†One of these yielded organisms from both the nose and the throat.

‡Ten of these were puerperal fever cases.

§This patient was not one of the puerperal fever cases.

Cultures from the sterile supplies in every instance yielded no growth of any kind; towels, gloves, compresses, sponges, and vulva pads in unopened bags were sterile. After the vulva bags had been opened organisms were found in the pads but these were not hemolytic streptococci. Towels, sheets, and blankets stored in the linen closets as well as those in the baskets from the laundry showed many organisms but in no instance any hemolytic streptococci.

Cultures from the water sterilizers yielded no growth in six examinations from the hot tanks; but in three of twelve examinations from the cold water tanks the culture yielded gram-positive and gram-negative bacilli but no streptococci.

Plates were exposed for periods of one-half hour to a day in the operating rooms and wards. The air coming from the ventilators and through the windows of the

operating rooms from the street was cultured also. In no instance was a hemolytic streptococcus found. Cultures from operating tables also yielded nothing.

The results of this survey and later cultures seemed to indicate that the only places where the hemolytic streptococci were present in sufficient quantities to be readily cultivable were the vaginas of the patients and the noses and throats of the attending staff. Inasmuch as it was not possible to determine by any rapid method, as will be pointed out later, whether the strains recovered from the staff were identical with or similar to the cultures from the patients, it was deemed wise to relieve the carriers from duty until their throat and nose cultures should be negative on two successive examinations on alternate days. The ill patients were isolated and put on strict individual precautions and nurses with positive throat cultures were placed in their charge. Suspicious cases including the two patients with positive vaginal cultures without symptoms were put in separate isolated wards under close observation.

C. In an attempt to answer the third question, "*When did the organism get into the patients?*" a careful analysis was made of each case. It was noted that in most of the cases the first peak of fever came on the third, fourth or fifth day after delivery. In Holmes' classic essay he states that in most of the cases of puerperal fever observed by or reported to him, the symptoms began in twenty-four to seventy-two hours. This would suggest that in our series there was either a smaller inoculum, or the organisms were introduced postpartum, or that in those early cases of Holmes, the introduction took place antepartum and had a period of incubation before the delivery took place. It has been found that it requires three to four days for vaginal organisms to get up into the uterus after delivery.<sup>7</sup> In our routine vaginal cultures the findings of a positive culture on the second day postpartum with the typical symptoms developing on the fifth day shed some light upon this point. It indicated that the organisms had been introduced some time before the second postpartum day and had an incubation period in the vagina and uterus of at least three days. It is of particular interest that three of these cases were delivered by cesarean section. We cannot say whether in these cases the organisms were introduced directly into the peritoneal cavity or into the vagina before or after delivery. During the same period no hemolytic streptococcus infection occurred in gynecologic cases operated on in the same room.

A study of the development of the cases gave no evidence of spread within a ward from patient to patient. The cases appeared here, there, and everywhere. All of the wards and all of the delivery rooms were concerned.

These facts seemed to lend weight to the idea that the patients were themselves bringing the organisms into the hospital. The general prevalence of hemolytic streptococcus infections throughout the city and rumors of similar epidemics in other hospitals made this idea worthy of consideration. On the other hand if such were the case one would have expected a more rapid development of symptoms. Furthermore, the occurrence of cases was far greater than could be accounted for by this source unless the prevalence of positive postpartum cultures were far greater than had ever been previously reported. Here 15 per cent of the admissions were coming down with puerperal fever whereas routine antepartum vaginal cultures reported by other observers had yielded no hemolytic streptococci in some series and the largest number we could find reported in the literature was 10 per cent.<sup>8</sup>

After the period of hospital closing was over and patients began to come in again we took cultures immediately on admission, antepartum and postpartum, and on the second, fourth, and seventh days. This was continued for three months and not once in 170 cases was a hemolytic streptococcus found on admission, and no positive vaginal cultures developed subsequently. The theory of the patients carrying the organism was finally disproved by the results of the biologic study

of the different strains of the organism, as we shall see later, although our findings do not preclude the possibility that the first patient brought the organism into the hospital.

D. The question, "*How did the organism get into the patients?*" is the question of paramount importance from the point of view of epidemiology. In fact it is the essence of the whole matter. We confess frankly that our data fail to answer it and give us very few actual facts to base judgment upon. We must approach this question by a process of exclusion. We believe that the negative cultures from the noses and throats of the sick patients argue against a hematogenous infection with the portal of entry in the nasopharynx. The biologic relationships of the different strains also make this possibility extremely remote. The negative stool cultures, although not numerous, bring evidence against the idea that the intestines were the source of the organisms. The pathologists found evidence in most cases that the uterus was the chief site of infection with an extensive lymphatic spread. The most likely route by which the uterus could be infected is by the vagina. Vaginal examinations and deliveries are not sterile procedures. It is not possible by any method that we know to sterilize the vagina or even the vulva. Organisms may be wiped in from the labia during the examinations or during delivery, or may be carried in on gloves, sponges, forceps or packing, or anything else which may be introduced. In this series of cases it is evident that the infecting organism was one of very high virulence, so that the introduction of a very small number of organisms might easily result in an infection, a number which under ordinary circumstances would be readily taken care of.

E. The question of *the nature of the organisms* has required seven months of intensive bacteriologic and serologic work to answer, but we believe that we have been able to answer certain phases of it with some assurance that we are on solid ground. During the epidemic we were able to collect 54 strains of hemolytic streptococci from the patients and from the noses and throats of the staff. Unfortunately the nose and throat cultures from the doctor who was associated with so many of the early cases were unsatisfactory because they had to be made in fluid medium. No hemolytic streptococci were recovered and further cultures were not possible because he left the city. The chief problem in working with these strains consisted in attempting to prove that any two of them were identical organisms. In our present knowledge of the biology of the hemolytic streptococcus this can be done only by the demonstration that the two strains are antigenically exactly alike, as Krumiede has shown.<sup>9</sup> Only identical organisms are antigenically exactly alike, and they will behave exactly alike under conditions of reciprocal cross absorption of agglutinin. By this is meant that when two identical strains are injected into different animals in the proper way, these animals will produce agglutinating immune sera which will agglutinate both of the strains. Moreover, when a sufficient number of these organisms are placed in contact with the serum for a short time, the organisms clump and fall to the bottom of the tube carrying with them the agglutinin. If the mixture of serum and organisms is centrifuged and the supernatant fluid is examined for agglutinin, it will be found that the agglutinin has been completely absorbed from the serum by the organisms. By reciprocal absorption of agglutinin is meant that either of two identical strains will completely absorb out the agglutinin not only from its own serum but from the serum produced by the other strain. On the other hand, it has been found that any given hemolytic streptococcus when injected into animals will produce an agglutinating antiserum which will agglutinate not only itself (the homologous strain) but many other strains of streptococci (heterologous strains). If, however, these heterologous strains are put in contact with this serum for a time and then the mixture is centrifuged, it is found that the supernatant serum, although

it will no longer agglutinate the heterologous strains used for absorption, will still agglutinate the homologous strain. In other words, heterologous nonidentical strains have not the power to completely absorb the agglutinin for the homologous strain.

In order to try the reciprocal absorption of agglutinin test in this series of strains, 7 of the 54 strains were selected for animal inoculation. Four of these strains were obtained from the blood in fatal cases, two were obtained from the vagina of two other sick patients and one from the throat of one of the doctors who was intimately associated with a number of the cases, and who proved to be a chronic carrier of the hemolytic streptococcus.

The details of this serologic study have been reported elsewhere.<sup>13</sup> Suffice it to say here that good agglutinating serum for 4 of these 7 strains was finally obtained: three were from the patients and one from the doctor. When these sera were tested for agglutination against each of the 54 strains from the epidemic, it was found that with a few exceptions the strains from the patients all fell into one group, but that the strain from the doctor's throat showed no agglutination and that the serum produced by this strain could not agglutinate any of the strains from the patients. Similarly, the majority of the strains carried in the noses and throats of the staff proved to give entirely negative tests. However, 6 of the nurses' strains fell into the same agglutinating group as the great majority of the patients.

When in turn, fresh animals were inoculated with these 6 strains and agglutinating serum obtained for them, it was found that only one of the nurse's strains fulfilled the requirements for reciprocal complete absorption of agglutinin. The strain from this nurse's nose and 5 of the patients' strains were demonstrated by this test to be biologically identical. These tests were repeated again and again and the results were always consistent (see Table II). Although it was not necessary nor warranted to obtain sera for all of the strains in the collection, it was found that ten of the other patients' strains completely absorbed out the agglutinin from the serum produced by the nurse's strain. Thus was demonstrated the probable identity of these 10 others besides the first 6. This included the 2 strains cultured from the vagina of the patients not clinically ill but who were vaginal carriers of the organism. Such a relationship was demonstrated also for the strains recovered from a nurse who during the progress of the epidemic was taken ill with hemolytic streptococcus peritonitis, and for the strain recovered from a nurse who developed an axillary abscess following the prick of the finger with a safety pin.

The strains from 5 of the patients failed to fall into the main biologic group. This may mean that they were casual, sporadic cases occurring coincidental with the epidemic but not a part of it. It is more likely, however, that these strains became changed during their frequent transplantations with respect to their agglutinating characteristics. All workers with agglutination of streptococci have observed these changes. It must be emphasized, therefore, that negative results prove nothing and this applies to the negative results with certain of the strains from noses and throats of the attendants as well as those from several of the patients. When negative results occur, we can only say that we have no evidence of identity or similarity. On the other hand, consistent positive results are always significant. Therefore, if out of all of these strains we had found only three identical, two from the patients and one from the staff, we would have been able to say with some assurance first, that this series of cases constituted a true epidemic and the organism was spread either from a common source to both patients or had passed directly from patient to patient, and second, that it was capable of being carried in the nose and throat of a member of the staff.

TABLE II. A CLASSIFICATION OF THE 54 STRAINS OF HEMOLYTIC STREPTOCOCCI OBTAINED FROM HOSPITAL PERSONNEL AND PATIENTS DURING THE EPIDEMIC OF PUERPERAL FEVER BY RECIPROCAL AGGLUTINATION AND ABSORPTION OF AGGLUTININ TESTS

STRAINS PROVED ANTIGENICALLY IDENTICAL BY RECIPROCAL TESTS			STRAINS PROBABLY IDENTICAL FULLY ABSORBING AGGLUTININ			STRAINS ANTIGENICALLY DISSIMILAR WHEN TEST WAS DONE†		
NAME		DELIVERED	NAME		DELIVERED	NAME		DELIVERED
Patient	L.†	Jan. 18	Patient	J.†	Jan. 18	Patient	Wh.	Jan. 29
"	E.	" 20	"	P.	" 26	"	Ce.	Feb. 7
"	Me†	" 31	"	D.	" 27	"	Se.	" 9
"	R.	Feb. 2	"	T.†	" 29	"	Co.	" 10
"	Ma #†	" 7	"	F.	" 30	"	Sc.	" 18
Nurse	H.	----	"	Ba.	Feb. 5	And twenty-two other strains from the noses or throats of nurses, doctors, students, nonprofessional staff, and patients.		
			"	O.*	" 6			
			"	Bl.	" 10			
			"	N.*	" 11			
			"	Wo.	" 13			
			Nurse	S.†	-----			
			"	Mo.§	-----			
			And nine other strains from patients' metastatic foci.					

†Indicates the fatal cases. From several of the early cases no cultures were obtained for this study.

#This case yielded a positive vaginal culture on the second day postpartum but did not give clinical signs of puerperal fever until three days later.

\*These cases yielded positive vaginal cultures but never showed any clinical signs of puerperal fever.

†It should be borne in mind that negative results with the reciprocal agglutination and absorption tests do not mean that these strains were not at one time similar to or identical with the other strains but simply that this similarity or identity cannot be demonstrated. Only positive results are significant.

†This strain was cultured from the peritoneum of the nurse with peritonitis.

§This strain was cultured from the axillary abscess of the nurse who pricked her finger with a pin.

This obvious question arises: Was the nurse, whose nose culture proved to be identical with 5 of the patients, the common source of all of the infections or did she accidentally pick up the organism from the original carrier or from a patient. The evidence seems to be definite that she was not the original carrier, for she did not come to the hospital until after the epidemic had started and her first cultures were negative. The nurse who was taken ill with peritonitis (the organism from which lesion is antigenically similar, if not identical with the 6 identical strains) was in the hospital some time before the epidemic began. Her illness began with swollen glands of the neck but one previous culture yielded no hemolytic streptococci from her nose or throat. Her sickness did not develop until twenty-seven days after the delivery of the first patient in the series. While it is entirely possible that she carried the organism for this length of time in her nose and throat and it was not found, it seems to us to be much more likely that she picked it up during the epidemic and that it invaded her soon afterward. These nurses were, therefore, victims rather than originators of the epidemic. It is not at all unlikely that they were in part responsible for its continuance.

#### SUMMARY

The facts brought out by this study may be summed up as follows:

1. Between January 18 and February 18, 1927, an epidemic of puerperal fever raged in the Sloane Maternity Hospital with approximately

15 per cent of all parturient patients attacked by the disease and with approximately 33 per cent mortality.

2. In the lochial discharges of all but one of the ill patients from whom vaginal cultures were taken, the hemolytic streptococcus was found.

3. Five of these strains were proved to be antigenically identical by cross agglutination and cross absorption of agglutinin tests.

4. Nineteen other strains were proved to be similar if not identical by the absorption of agglutinin tests.

5. Two vaginal strains from patients not clinically ill are included in the nineteen just mentioned.

6. Twenty out of one hundred nurses were found to be carriers of hemolytic streptococcus either in the nose or in the throat or in both places.

7. Two out of twenty-six doctors were found to be chronic carriers.

8. Three out of sixty members of the nonprofessional employees of the hospital were found to be carriers.

9. Ten of the ill patients and 31 of the other patients were examined for the hemolytic streptococcus in nose and throat. None of the puerperal fever patients yielded positive nose or throat cultures and only two of the well patients.

10. In a serologic study of the strains recovered from the staff one strain from the nose of a nurse was proved by reciprocal cross agglutination and cross absorption of agglutinin tests to be identical with the 5 identical strains from the puerperal fever cases mentioned above. Thus it was demonstrated that the organism could be carried in the nasopharynx without causing serious illness.

11. One strain from the axillary abscess of a nurse whose finger was pricked and one strain from the peritoneum of another nurse taken ill during the epidemic were proved by absorption of agglutinin tests to be similar to, if not identical with, the identical strains from the puerperal fever cases.

12. Twenty-eight cultures of the air in the operating rooms and wards, including the isolation and the septic wards, made by leaving blood agar plates exposed from one-half to twenty-four hours, in no instance yielded hemolytic streptococci.

13. Cultures of linen from the laundry and blankets in the linen closets yielded no hemolytic streptococci.

14. These organisms could not be found in the sterilized supplies and fluids.

15. The peak of fever, indicating the clinical onset of the disease, came on an average of four days postpartum and 72 per cent of the patients had their first peak on the third, fourth, or fifth day postpartum.

16. In one of the cases which later proved to be fatal, hemolytic



streptococci were found in the vagina on the second day postpartum, and the onset of clinical symptoms came three days later.

17. Four of the patients were delivered by cesarean section.

18. In the early stages of the epidemic, antepartum vaginal examinations were made by the staff members with the nose and mouth unmasked. Delivery was carried out with the operating staff with masked mouths but not noses. Nurses caring for the patients after delivery were not masked at all.

19. The infection arose in cases delivered under variable conditions in different delivery rooms and sent to different wards after delivery.

20. The strains from the patients proved to be very virulent for rabbits, small quantities of living culture often killed after months of intravenous inoculation of dead organisms.

### CONCLUSIONS

From these facts it would seem logical to conclude that:

1. This series of puerperal fever cases constituted a true local epidemic.

2. The organisms did not enter the patients by the portals of the nose or throat.

3. It was not a hematogenous infection.

4. Each patient did not carry her own strain of hemolytic streptococcus in the vagina on admission to the hospital.

5. The organisms entered the patients either just before, during, or directly after delivery.

6. The portal of entry was the vagina.

7. It is extremely unlikely that these organisms passed directly from patient to patient. In all probability they were conveyed to the patients by one or more carriers.

### RECOMMENDATIONS

Although the facts do not permit us to draw more definite conclusions as to the time and manner of introduction of the organisms into the patients, they serve as a logical basis for certain suggestions for procedure until more is known about the preepidemic and early epidemic stages.

Prevention of disease is seldom as spectacular as cure. It only appeals to the most far-sighted mind. Prevention is expensive if carried out to the finest detail, but the ideal should be approached as nearly as possible and funds should not be difficult to obtain for preventive measures when some shocking experience like this is encountered which crystallizes, and thus makes visible its practicality.

It is impossible to prevent the entrance into a maternity hospital of a virulent organism capable of producing an epidemic of this kind, but the chances of its entrance may be reduced to a minimum and it is

possible to discover its presence soon after its arrival. At the same time the chance of its introduction into the vaginas of patients before, during, and after delivery may be minimized. If it has entered, it may be promptly isolated and the epidemic may be stopped. We are hoping that this study will influence the authorities of obstetric hospitals hearing or reading this report, until further facts are established with regard to puerperal fever, to find ways and means to adopt every measure by which these things may be accomplished.

We believe that:

1. There should be a group of workers constantly busy taking weekly nose and throat cultures on staff members. Similar cultures as well as vaginal cultures should also be taken on every patient on admission and in the postpartum course as indicated. The only way that facts can be determined about the preepidemic or early epidemic stages is to have such an organization. The only way we found the solution of the problem of streptococcus wound infection at the Presbyterian Hospital mentioned above, was that the stage was all set for the development of the last case. A group of investigators called in during the middle of an epidemic can do little to stop it and can determine very few facts regarding it. It is very analogous to the difference between a permanent and a voluntary fire department. The former is constantly determining fire menaces and is ready at a moment's notice to put out fires soon after they begin. With the latter there is no fire prevention and when fires occur the individuals have to leave their personal duties, get together, collect some makeshift apparatus, and often reach the fire when it has already spread from cellar to attic.

2. If staff members are found to harbor hemolytic streptococci they should be relieved from duty if possible. In any case they should be kept isolated from the parturient patients just before, during, or just after labor. Active local treatment of the nose and throat should be rigidly followed.

3. All nurses coming for training should have cultures made from nose and throat in their own hospitals and not admitted if these cultures are positive.

4. Patients with positive cultures in nose or throat or vagina should be isolated and local treatment be regularly carried out.

5. Antepartum examinations should be minimized and all examiners and all attendants should mask both nose and mouth during the examination.

6. During labor the attendants should rigidly mask both nose and mouth.

7. After delivery the attendants should adequately mask both nose and mouth whenever vaginal examinations are made or pads are changed. Hands should be washed in antiseptic solutions before each application of vulva pads.

8. During the late winter and early spring months all staff members should use antiseptic nose and throat washes.

9. During this season also all visitors should be masked and not admitted with active colds.

10. If an epidemic occurs, all carriers should be found at once and relieved from duty. If the epidemic does not stop in five or six days, the hospital should be closed.

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### A BACTERIOLOGIC STUDY OF THE PUERPERAL BLADDER\*

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**B**ACTERIOLOGIC studies of the bladder in children and in pregnant women have been reported frequently in recent medical literature, likewise numerous experimental studies on animals. There has been apparently no work on the puerperal bladder, however. This investigation was undertaken to determine whether the puerperal bladder contained bacteria, and if so, to study and classify them according to types.

Bacteria are known to cause many pathologic conditions in the urinary tract of which pyelonephritis, pyelitis, cystitis and various combinations of the above are the most common. While the bacteriology of these has been studied extensively, few observations have been made on the bacteriology of the normal bladder. It has been shown<sup>1</sup> that typhoid and other organisms may be excreted in enormous numbers under certain circumstances without clinical evidence of damage to the urinary tract.

The importance of bacteria in the urine in diseases of the urinary tract has been emphasized by many workers. If bacteria are found in the normal puerperal bladder, then the isolation of organisms in pyelitis, cystitis, or pyelonephritis is of less etiologic and diagnostic value

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than is generally believed. Some information may also be elicited regarding the danger of repeated catheterization of the puerperal bladder producing catheter cystitis if a careful technic is followed.

The relation of bacteria to pyelitis of pregnancy is well known. Many clinical studies on the etiology of pyelitis of pregnancy have been reported during the last ten years, and much experimental work done to establish the exact mode of infection. Falls<sup>2</sup> in reviewing the literature found two main theories as to the pathogenesis; the French school believes that infection of the pelvis of the kidney occurs via the blood stream. The German school considers pyelitis as an ascending infection which occurs along the lumen of the ureter. Mackey<sup>3</sup> in addition to these two theories stresses the possibility of transparietal infection by way of anastomosing lymphatics of the colon or bladder and the lymphatics of the kidney.

Although not accepted by all workers, there has been considerable evidence advanced which favors the theory that bacteria can and do travel up the lumen of the ureter and set up an inflammation in the pelvis of the kidney. Cabot and Crabtree<sup>4</sup> claim that no clinical or experimental evidence has been advanced that would support the ascending theory. Goldfadder<sup>5</sup> favors the hematogenous theory. Eisendrath and Schultz<sup>6</sup> conclude from experimental and clinical data that the lymphatic system carries the infection unless the ureters are almost completely blocked. Widal and Bernard<sup>7</sup> believe pyelitis is essentially a bacteremia. Eisendrath and Kahn<sup>8</sup> and Walker<sup>9</sup> studied the lymphatics in animals first infecting the bladder and then making serial sections of the periureteral lymphatics. They both conclude because of round-celled infiltration and evidences of mild infection that the pelvis is infected by the lymphatic channels.

V. C. David<sup>10</sup> believes that the infection can ascend up the lumen of the ureter and is able to produce an ascending pyelitis in dogs. He concludes that extension will take place with only slight obstruction to complete emptying of the bladder. Curtis<sup>11</sup> states that organisms may ascend from an infected residual urine up the ureters and produce a pyelitis. Williams<sup>12</sup> speaks of a cystitis which may ascend the ureters and cause either a pyelitis or pyelonephritis.

Wislocki and O'Connor<sup>13</sup> working with rabbits showed that regurgitation of fluid up the ureters was possible if the bladder was first moderately distended. A solution of methylene blue was injected into the bladder until distended and the ureters examined. They found that in some cases the peristalsis was insufficient and the fluid would ascend to the pelvis of the kidney. Hundley<sup>14</sup> states that when tried on dogs the results are less striking, so that we do not know that regurgitation would be as simple in the human as in the rabbit. However, Kohrer quotes Volker<sup>15</sup> as having shown that collargol injected into the human bladder can be detected in the pelvis shortly after. He explains this by assuming that antiperistalsis is set up in the ureter due to irritation.

McDonald<sup>16</sup> has described the patulous flattened "golf hole" ureteral orifice found in certain pregnant women, and considers the condition to be due to the stretching of the intraureteral bladder ligament by the growing cervix of the pregnant uterus. The author believes infection may ascend up such ureters.

Koll in discussing a paper on pyelitis by Crabtree and Cabot<sup>17</sup> suggests that bacteria are excreted by the kidney without clinical evidence, a latent condition lasting from infancy and that pyelitis of pregnancy is an acute exacerbation due to

pregnancy as the predisposing cause. He contends that 90 per cent of all women give histories of "kidney trouble" in childhood which he interprets as pyelitis. Falls<sup>2</sup> also suggests such a possibility.

Beeler and Helmholtz,<sup>18</sup> however, found that in girls over two years of age the urine was almost always free of organisms and entirely free of those belonging to the so-called colon group. Langer and Soldin<sup>19</sup> state that they were able to isolate streptococcus lacticus in every one of the 138 patients they examined when repeated cultures were made. Hartshorn<sup>20</sup> states that in one-half of the healthy children the urine is free of bacteria.

The bladder as a possible source of puerperal sepsis must be considered in certain cases especially when large numbers of organisms are found in the urine. However, it has been shown<sup>2</sup> that puerperal sepsis does not necessarily follow bacteriuria. Catheterization of such cases would be a step in understanding such infections when they do occur.

Several cases of toxemias of pregnancy were observed by the author to determine if there were variation in the bacterial content of urinary tract from the normal puerperal bladder.

Authorities differ concerning the bacterial content of the normal bladder. Crabtree<sup>21</sup> stated in 1916 without giving data that the urine contains many types of organisms, most of which were nonpathogenic. Hale-White<sup>22</sup> reported results on fifty-six nonpregnant women all of whom were in the hospital with extraordinary affections. All of these women had sterile urine when carefully examined and inoculated on culture media. He stated, however, that it is commonly believed that *Bacillus coli* are frequently found in urine of pregnant women. He felt that further investigation was necessary before conclusions could be drawn. In a later article<sup>23</sup> (1922) he also repeated this statement but gave no data. Williams<sup>24</sup> catheterized 70 women, 44 of whom suffered from long standing intestinal disorders. Sixteen of these 44 cases showed *Bacillus coli* in the bladder urine. Of the remaining 26 cases that gave no history of constipation there were none that harbored any of the colon group. Albeck<sup>25</sup> in 1907 stated that of 392 pregnant women catheterized in L Meyer's Clinic in Copenhagen, bacteria were found in 8.16 per cent.

Hewitt<sup>26</sup> reports three series of cases. In the first series Pantou catheterized 100 women comprising various extraordinary conditions and found 18 per cent sterile. Of the organisms *Staphylococcus albus* occurred in 62 per cent of the number, *Bacillus coli* in 7 per cent, *Bacillus proteus* in 6 per cent, other coliform organisms in 1 per cent. Gough catheterized 100 females in the hospital for gynecologic conditions and found 30 per cent sterile. In this group 56 per cent had *Staphylococcus albus* and 12 per cent *Bacillus coli*. A third series by Hewitt comprising 100 females who were pregnant, of which 32 per cent had sterile urine. *Staphylococcus albus* was present 35 per cent and *Bacillus coli* in 30 per cent. He concludes that staphylococci predominate in normal urine and that catheterized specimens are rarely sterile. Keene discussing a paper by Vaux<sup>27</sup> says that bacilluria is very common in pregnancy.

Engelhorn<sup>28</sup> examined the urine of 35 pregnant women and found it sterile in 14. In 10 of the 21 in which organisms were found there were symptoms of cystitis. The remaining 11 had no signs of an infection other than bacteria in the urine. Falls<sup>2</sup> reports 10 patients all pregnant, having no signs or symptoms of bladder infection. These women voided spontaneously and were then catheterized

immediately and the residual urine examined and incubated on culture media. Six of the ten cases showed organisms, *Bacillus coli* in all cases and *Staphylococcus albus* in symbiosis in four of the six. The remaining four were sterile.

Danforth<sup>29</sup> catheterized 50 normal pregnant women and found a pure culture of staphylococci in 32. Two cases showed a pure culture of *Bacillus coli* and three a mixture of *Staphylococcus albus* and the colon bacillus. The remaining 13 were sterile. In a second series 14 women were catheterized after being prepared for delivery. Eight of these grew staphylococci and one had an anaërobic growth not named. All of the first series and a majority of the second were catheterized by a nurse.

It would appear from this review that there are bacteria in the bladder of normal women, both the pregnant and nonpregnant. The organisms most frequently recovered are staphylococci and *Bacillus coli*. There is no apparent reason why the bacterial flora of pregnant and nonpregnant women should differ.

Two series of cases will be reported. The first consists of 51 puerperal women who had not been catheterized previous to or at delivery. The second series of 7 who had been catheterized incidental to delivery and this first specimen not saved.

*Procedure.*—Each case was carefully catheterized three times at intervals of forty-eight hours. The first specimen was obtained about twenty-four hours after delivery. No cases were included where, because of tenderness or swelling of the genitalia, contamination of the specimen was likely.

The first five cubic centimeters were allowed to drain through the catheter and discarded. Beeler and Helmholtz<sup>18</sup> collected their specimens in three tubes considering the first portion as urethral. This first portion cannot be representative of the bacterial flora of the urethra because of mechanical reasons. A few organisms may enter the catheter as it is inserted into the bladder and it was to avoid such contamination that we discarded the first portion. The next thirty to forty cubic centimeters of urine was then collected in a large sterile centrifuge tube. The tubes were centrifuged for ten minutes at approximately eight thousand revolutions per minute to sediment the bacteria if present. A routine urinalysis was run in addition to the bacteriologic tests and the results are shown in Table I. One loop of the sediment was examined in the hanging drop to determine motility of the bacteria if present. A second portion was examined in a direct stained smear using Gram's method. A third portion was plated out on blood agar, two plates being used for each sample. The first plate we streaked out one loopfull (which is approximately 1 cubic millimeter) while for the second we plated out five cubic centimeters of urine.

Crabtree<sup>21</sup> has rightly emphasized the importance of stained smears of centrifuged urine. He found that by carefully examining centrifuged specimens he could correlate these results with inoculations in every case. We found that our smears agreed with results of inoculation in 96.15 per cent of the cases in a total number of 156 smears examined.

There are certain risks in catheterizing a puerperal case three times in six days. Williams<sup>30</sup> states that no matter how carefully performed, catheterization carries with it a certain danger of cystitis. Luetsche<sup>31</sup> considers catheterization a very serious procedure especially when local conditions such as trauma following labor, etc., are present. Besides determining the frequency of catheter cystitis the second and third specimens enable one to determine whether or not organisms are forced in to the bladder by catheterization, and indirectly it will determine the flora of the urethra

if organisms are forced in. Day<sup>32</sup> however, states that catheterization of the healthy bladder will cause cystitis only when there is a retention of small amounts causing residual urine or retention with distention. He further states that introduction of pyogenic organisms into healthy bladder will not cause cystitis even with considerable trauma provided there is no distention or residual urine.

Meat infusion blood agar plates were used since they meet practically all the requirements for such work. McKinzie and Cochrane<sup>33</sup> used liquid media in which to incubate the urine and Langer and Soldin<sup>19</sup> report using liquid culture media.

The advantages of solid media are that isolated colonies of various bacteria may be distinguished and that one can determine the relative number of organisms present in the specimen.

*Results.*—Of the 51 cases reported only four had organisms at the first catheterization, 92.16 per cent being sterile. Twenty-five cases or 49 per cent were sterile on all three occasions. This means that 51 per cent of the cases that had sterile cultures on the first catheterization remained sterile for the two subsequent. Four cases had sterile cultures for the first two samples but showed organisms in the last specimen taken on the fifth day postpartum.

TABLE I

		PER CENT
Number in series	51	
Number sterile three times	25	49.0
Number showing bacteria	26	51.0
Number showing bacteria first	4	7.8
Number showing bacteria second	18	35.3
Number showing bacteria third	4	7.8

Of the four cases showing bacteria on the first inoculation one grew a pure culture of *Staphylococcus aureus*, one grew a pure culture of a gram-positive bacillus of the diphtheroid group. The other two patients had mixed cultures of *Staphylococcus albus* and diphtheroids. One of these had fever and tenderness over the abdomen and was diagnosed perimetritis. Later (on fifth day) when the third specimen was obtained the urine was sterile. This is the only instance of this finding in the series. All symptoms had disappeared in the interim.

Table II gives the strains of organisms found and the number of times isolated.

TABLE II

ORGANISM	TIMES ISOLATED
<i>Staphylococcus albus</i> —pure culture	14
Diphtheroids—pure culture	13
Both in symbiosis	14
<i>Staphylococcus aureus</i>	1
<i>Neisseria catarrhalis</i>	3
<i>Streptococcus lacticus</i>	2 (same case)
<i>Bacillus coli</i>	2 (same case)

Apparently delivery from above by cesarean section, which minimized the influence of bladder trauma, does not influence the results, for in two of the women in Series I the urine was sterile at first catheterization with organisms present in subsequent specimens.

One case developed eclampsia but had no organisms on first catheterization. The second and third specimens did show a pure culture of *Staphylococcus albus*. Two other cases developed definite signs of pre-eclamptic toxemia and one apparently had a nephritic toxemia. All were sterile with the first specimen showing organisms on the third and fifth days postpartum when the other catheterizations were done.

Series II. Here the procedure and technic were identical except that the first specimen was not available for culture and the first one recorded is the second catheterization. In all these specimens organisms were found except in one. Table III shows the organisms recovered.

TABLE III

PATIENT NO.	CATHETERIZATION		
	1	2	3
1	<i>Staph. albus</i>	<i>Staph. albus</i>	<i>Staph. albus</i>
2	<i>Staph. aureus</i>	<i>Staph. aureus</i>	<i>Staph. aureus</i>
3	<i>Staph. albus</i>	<i>Staph. albus</i>	<i>Staph. albus</i>
4	<i>Bacillus coli</i>	<i>Bacillus coli</i>	<i>Bacillus coli</i>
5	Sterile	<i>Staph. albus</i>	<i>Staph. albus</i>
6	Diphtheroids	<i>Staph. albus</i>	<i>Staph. albus</i>
7	Diphtheroids	Diphtheroids	Diphtheroids

None of the 58 women studied in both series developed cystitis or any symptoms referable to infection of the urinary tract.

Out of 177 specimens plated out, the colon bacillus showed up in only five plates and three of these on one case which had previously been catheterized by a nurse because of retention. The other two times it appeared was in the second and third catheterization of a case which we had previously found sterile urine. Only two cases, one in Series I and one in Series II showed *Bacillus coli* in their bladder. In other words out of 58 women examined only 3.4 per cent of them yielded a coliform organism in the urine. Neither of these women showed any evidence of cystitis.

#### CONCLUSIONS

1. The normal puerperal bladder in this series was sterile in 92.16 per cent of cases, at the primary catheterization.

2. Subsequent catheterizations yielded positive cultures in 51 per cent of cases. No symptoms of cystitis were noted in these patients.

3. There is relatively little danger of catheter cystitis when catheterization is carefully performed.



4. The organisms recovered in this series were relatively nonpathogenic, *Staphylococcus albus*, *Diphtheroids*, and *Streptococcus lacticus*.
5. The colon bacillus is rarely found in the normal puerperal bladder.
6. The type of organisms found suggest the probable nature of the bacterial flora of the urethra.
7. The finding of the colon bacillus in women during pregnancy or the puerperium suggests the possibility of pathology in the urinary system, particularly pyelitis.
8. The puerperal bladder following the two cases of cesarean section yielded the same results as those delivered from below.
9. The few cases of toxemias of pregnancy which we studied gave similar results to those who had a normal pregnancy and puerperium.

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## SOME OBSERVATIONS BASED ON ROUTINE INVESTIGATION OF THE KIDNEYS IN THE TOXEMIAS OF PREGNANCY\*

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OF ALL theories advanced concerning the causative factors of the toxemia of pregnancy, none has a greater appeal than deranged kidney function, interpreted in its broadest sense. In fact, the rôle of the urinary organs in a toxemia of pregnancy is always of the utmost importance. My own confidence in these premises prompted the investigations I desire to report herewith. In a review of the literature, it is evident that numerous investigators concur in these views, both from studies in vivo and in the postmortem laboratory. Prutz, in a collection of 360 autopsies after eclampsia, found renal involvement in all but 7 cases. Pollack, of Vienna, confirmed these findings and noted renal involvement in 98 per cent in a series of 139 cases. Bugbee states that the frequency of renal infections in pregnancy is not generally appreciated and expresses the belief that the process is hematogenous and originates in the colon.

For the sake of simplicity and brevity it is well to divide the toxemias of pregnancy into the early and late. In the early cases are included those of pernicious vomiting, and in the late the eclampsias. Conceding that some women go through pregnancy without discomfort, while others are miserable, the fact that there must be something circulating in the maternal blood responsible for the untoward symptoms cannot be disputed. I believe that this is a toxin originating in the kidney primarily and distributed by the blood stream. I have had an opportunity to investigate and treat 52 cases of toxemia, and the end-results have been so striking and gratifying that I have made a routine investigation in every case of pregnancy presenting the slightest evidence of toxemia.

A case was regarded as one of mild toxemia when there was persistent nausea and vomiting except for the retention of fluids, with stationary or slight loss of weight. If allowed to progress, such patients may reach the stage of hyperemesis gravidarum. Many cases of mild toxemia have been said to show normal urinary findings, yet when a complete investigation is made, the findings are really abnormal. All patients in this series manifested an increase in blood pressure, ranging from 30 to 100 mm. of mercury. Four of these women were comatose and well-advanced in their pregnancy, and when first seen presented the picture of profound uremia. Nevertheless, they

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responded promptly to the remedial measures applied, and three of them went to term and were delivered of living babies.

All patients in this series of cases who developed any elevation of systolic blood pressure as compared with the reading at a previous examination, even though without other symptoms of toxemia, were subjected to the following routine investigation of the urinary tract; the same measures were also applied to those with mild or severe toxemia.

1. A careful history concerning a possible renal or other urogenital involvement in infancy, puberty, or adolescence, or following abortion, operation, etc.

2. Careful analysis of specimens of urine, taken both day and night.

3. Cystoscopic examination of the bladder.

4. Passage of catheters into both ureters at separate sittings, to exclude obstruction within the ureters by stone or stricture, or obstruction by extrinsic pressure.

5. Collection of urine from each side for evidence of pyelitis or pyelonephritis (macroscopic and microscopic investigation as well as a pus cell count).

6. Culture of these specimens for staphylococci, streptococci, colon or tubercle bacilli.

7. Renal function tests: indigo-carmin or phenolsulphonephthalein.

8. Pyelographic studies whenever indicated.

An examination that includes all of these details upon the faintest suspicion of toxemia in early pregnancy, will provide a wealth of valuable information. In fact, it is the early discovery of renal or ureteric alterations that offers most in the prophylaxis of the toxemias. A catheterized specimen of bladder urine rarely yields sufficient information, as pus cells are often mistakenly attributed to a cystitis.

After the urine has been collected from each kidney, it should be inspected macroscopically for turbidity, mucous shreds, flakes, and débris. Microscopically, the examination should include a search for bacteria, epithelial cells, pus cells, and in acute cases, red blood cells. It is well to make sure, however, that the red cells are not due to the trauma of the catheterization. In cases of pyelonephritis or those with other renal parenchymal disease, hyaline and granular casts, besides the albumin and pus, will be found as evidence of such involvement. Directly proportionate with the degree of renal parenchyma, the elimination of indigo-carmin will be delayed after intravenous injection.

Of the 52 cases studied, 40 showed turbidity of the urine in catheterized specimens taken from one or both kidneys. This turbidity was not dissipated by heat, and the gross appearance of the specimens revealed flakes, shreds, or débris. Microscopic examination disclosed the presence of pus cells, epithelial cells, numerous shreds, and various cocci and bacilli, and hyaline or granular casts. The right side was affected in 22, the left in 16, and both in 8 cases. Clear specimens, suggestive of no gross renal pathology, were obtained in 6 cases. Cultures were made of all urine specimens. The colon bacillus predominated, being found in 24 cases, the staphylococcus in 7 cases, and

the streptococcus in 5 cases; mixed infection occurred in 9 cases (colon bacilli and staphylococcus); the *Bacillus proteus* was found in 1 case; cultures were negative in 6 cases.

Complicating pathologic conditions were found in several cases. Ureteral stricture occurred in 5 (3 on the right and 2 on the left side); stone in the pelvis or ureter was discovered in 3; hydronephrosis was found in 2 and pyonephrosis in 3 cases; and there was ptosis of the kidney and kinked ureter in 2 cases. Pyelitis was differentiated from pyelonephritis by the presence of hyaline and granular casts in the urinary sediment of the latter group. In the 6 cases that did not present urinary abnormalities and showed negative cultures, and in whom there was persistent nausea, vomiting, etc., 2 patients had a pronounced retrodisplacement, 1 had a severe nasopharyngeal catarrh, 2 were guilty of dietary indiscretions, and 1 had disease of the nasal accessory sinuses. In the 46 cases that showed definite evidence of renal involvement, the indigo-carmin excretion was delayed from 9 to 30 minutes, depending upon the degree of functional impairment. In 2 cases there was no elimination of dye at the end of two hours. Pyelographic studies were only made in cases in which stone, dilatation of the renal pelvis, hydronephrosis, or pyonephrosis were suspected.

After the diagnostic measures I have outlined were carried out and the renal lesion determined, treatment was instituted. A urinary antiseptic was given by mouth. Caprokol in full doses proved to be efficacious in many cases. Some of our clinic patients complained of the expense of this drug, so effervescent granules of formohydrion (Merck) were substituted. This was given in teaspoonful doses in a tumblerful of water every four hours with excellent results. The free ingestion of water was encouraged as soon as vomiting began to lessen. Water is preferably given in small quantities at frequent intervals. Special attention was directed to constipation, but drastic cathartics were never used. All patients were given colonic irrigations. Corpus luteum extract, insulin, glucose, liver extract, calcium, and placental extract were not prescribed at all.

In every case a careful search was made for a focus of infection in the teeth, tonsils, sinuses, and cervix. Some patients were benefited considerably by injections of autogenous vaccines, made from the kidney urine cultures, but the most important therapeutic procedures were the local measures directed to the kidney itself. These consisted of irrigating the renal pelvis and dilated calyces, by means of a double catheter, using boric acid, 2 per cent, saline or sterile water. Lavage of the renal pelvis was repeated until the fluid returned clear, after which from 5 to 10 c.c. of neosilvol, 5 per cent, mercurochrome, 1 per cent, or silver nitrate, 2 per cent, were instilled into the renal pelvis. I prefer neosilvol as it does not stain, or irrigate the tissues. Mercurochrome may discolor the urine red and alarm the patient. Silver

nitrate precipitates the chlorides in the urine, and soon loses its effect. The irrigations and instillations were repeated every fourth or fifth day, depending upon the severity of the case.

In eight cases indwelling catheters were left in the ureters for several days until satisfactory drainage was established. It is very important to irrigate these catheters carefully to insure continuous drainage, as they may become plugged. In those cases in which there was an acute exacerbation of a chronic inflammation, such as acute congestion, edema, swelling, etc., no local treatment was applied until the acute process had subsided. Often within forty-eight hours after the insertion of an indwelling catheter, the general symptoms improved. At the first sitting a No. 5 F. catheter with a whistle tip was used. In some instances the suppuration was so severe that there was no drainage from one side, although normal urine came down the other, thus making it appear that the output of urine was normal. As the patients improved and the urine cleared, catheterization was done once a week. As the renal involvement abated, the toxemia and hypertension diminished. After the patient was symptom-free, the ureter was dilated as a terminal measure to prevent the formation of an inflammatory stricture and obstruction of the renal pelvis.

In most of the cases treated there was a coincident cystitis, and the bladder was also treated by intravesical irrigations or instillations, using the silver salts, mercurochrome, or acriflavine. The necessary special procedures were of course utilized for the treatment of strictures and calculi.

In 6 cases I had expected to do a therapeutic abortion for toxemia, but the patients went to term and were delivered of viable children, 5 of whom are now alive and well.

#### CONCLUSIONS

1. The kidney of pregnancy appears to be an important etiologic factor in the toxemias of pregnancy. This kidney is usually one that has been previously affected in childhood, puberty, or adolescence, or has become secondarily involved from extraneous foci of infection.

2. A careful routine study of the kidneys in pregnancy will offer a solution of the problem of toxemia in many cases.

3. Routine catheterization of both ureters should be done in all cases of pregnancy manifesting an early toxemia, or arterial hypertension without symptoms of toxemia. Every obstetrician can easily acquire the technic of cystoscopy, as cystoscopy in the female is not difficult.

4. Many patients previously referred to the obstetrician for the instrumental termination of pregnancy can be safely carried to term, if a definite renal or ureteral involvement is found and adequately treated.

A CASE OF PYOSALPINX CAUSED BY OXYURIS  
VERMICULARIS COMPLICATED BY TORSION  
OF THE OVIDUCT\*

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THIS case is presented on account of the rarity of the condition, the unusual clinical manifestations, and the distinctive lesions found.

A twenty-three-year old, white, single, nullipara, a stenographer by occupation, was admitted to Brooklyn Hospital on November 29, 1927. She had been well and had worked regularly until October 1, 1927. Her menses had always been regular and painless. On October 1 she first noticed pain in the right lower abdomen. This was worse when standing and became so much worse in a few days that she was unable to work.

She consulted her family physician who ordered her to bed and applied an ice bag to the abdomen. The temperature at this time was only slightly elevated. The physician made a pelvic examination and felt a mass in the right broad ligament and a smaller one on the left side. Rest in bed relieved the pain considerably. The menses occurred at the proper time, October 18, but lasted two weeks.

The patient first came under observation on November 27, 1927, six weeks after her first attack of pain. She was pale and thin, but not acutely ill or confined to bed. No abnormal physical signs were elicited in her chest, no masses were palpable on abdominal examination, but the lower part of the abdomen on the right was tender. Vaginal examination showed a tight two-finger introitus. The cervix was slightly eroded. The uterus was in an anterior position and pushed over to the left side of the pelvis. The right side of the pelvis contained a large cystic mass which was acutely tender and not readily movable. The left adnexum did not appear enlarged (an error in palpation). There was no gross evidence of gonorrheal infection. Smears from the cervix and urethra did not contain gonococci. The patient was intelligent and cooperative and denied ever having had gonorrhea but admitted having had sexual intercourse. Operation was recommended but, as the pain was subsiding, it was thought best to defer the operation until after the next menses. The provisional diagnosis made at the time was ovarian cyst, with a twisted pedicle. The next menses were on November 5, they lasted five days and were normal in character. Three days after this ended, the patient came to the hospital for operation.

On admission, the pulse, temperature, and respirations were normal. Blood pressure, 130/80. The urine was normal. Hemoglobin 85 per cent. Red cells 4,400,000, white cells 9,700, polymorphonuclears 60 per cent. The Wassermann reaction was negative. Physical examination of the chest and abdomen showed nothing additional. The vaginal examination yielded the findings previously stated.

*Operation.*—The abdomen was opened in the median line below the umbilicus. The right tube in its outer two thirds was greatly distended, cystic, and adherent

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to the uterus and intestines. The inner third of the tube was small, flat, and completely twisted on itself from right to left. The left tube and ovary were much enlarged and adherent to the left side of the uterus and to the intestines. The uterus was small and in an anterior position. The peritoneum and external surfaces of the tubes were examined for tubercles but none were found. The process was looked upon as gonorrheal in origin. The uterus was removed supra-

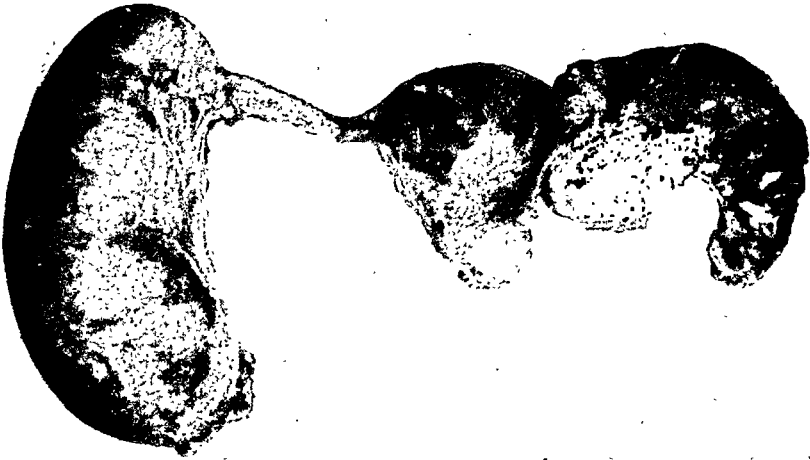


Fig. 1.—Right oviduct dilated and filled with puriform material. The left oviduct and ovary fused in a mass of inflammatory tissue.



Fig. 2.—Margin of an area of anemic necrosis in the wall of the oviduct.

vaginally with the left tube and ovary and the right tube and the appendix. The right ovary was left in its dense bed of adhesions. All the adhesions were very dense and old. The left tube was ruptured in removal. The pus from the tube yielded no growth on culture media. The cervix stump was split and vaginal drainage instituted. The abdominal wound was closed without drainage except for a small bit of rubber tissue in the fat layer. Convalescence was uneventful and the patient left the hospital on the twenty-first day after the operation. On

discharge, the abdominal wound had healed by primary union. The pelvis was free from exudate, but there was still some discharge from the split cervix.

The patient regained her strength rapidly after leaving the hospital and returned to her regular work in one month.

Examination by Dr. Denton of the left oviduct showed that its increase in size was due to an extensive inflammatory process in the wall of the tube. The major share of the thickening of the wall was due to infiltration of the mucous membrane and submucosa by cells of the lymphocyte order, to large mononuclear cells and to fibroblastic reaction. Foreign body giant cells were very numerous. The puriform material observed grossly was not pus but a product of anemic necrosis which contained no polynuclear leucocytes. In all the microscopic preparations the thin shells of small, round worms were found. In places the sections passed through the central parts of the bodies of the worms and in others through the thinner ends of the parasites. From the size, shape, and thickness of the



Fig. 3.—Foreign body tubercle at one end of an *Oxyuris vermicularis*.

body walls of the worms they were considered to be *Oxyuris vermicularis*. About all the worms there was a very marked foreign body reaction with large multinucleated giant cells about the parasites. The body shells gave a microchemical reaction similar to that given by chitin. A careful search of the sections revealed no identifiable ova.

The central softening of the tube appeared clearly to be due to anemic necrosis caused by gradual devascularization of the inflammatory products in the wall of the tube.

The histologic details were not dissimilar to those produced by tuberculosis in the oviduct except that no small, typical tubercles were found. The anemic necrosis gave an appearance very similar to caseation and numerous focal areas were found which resembled reticulated tubercles.

After finding these unusual parasites in the mucous membrane of the tube, the stools were carefully examined for parasites and ova, but none were found.



The blood showed no increase in eosinophile cells. A small amount of pus from the vaginal discharge was injected into a guinea pig and the pig was killed later, but no lesions were found.

*Comment.*—The case is of unusual interest on account of the unusual etiology, the complicating torsion of the oviduct and on account of the

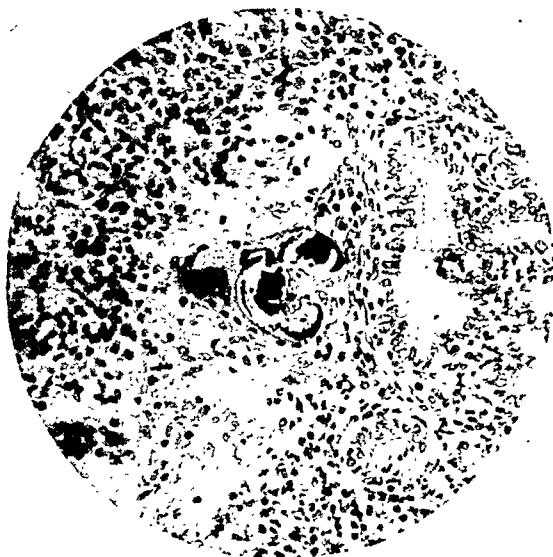


Fig. 4.—Foreign body giant cell forming about *Oxyuris vermicularis* in the submucosa of the oviduct.

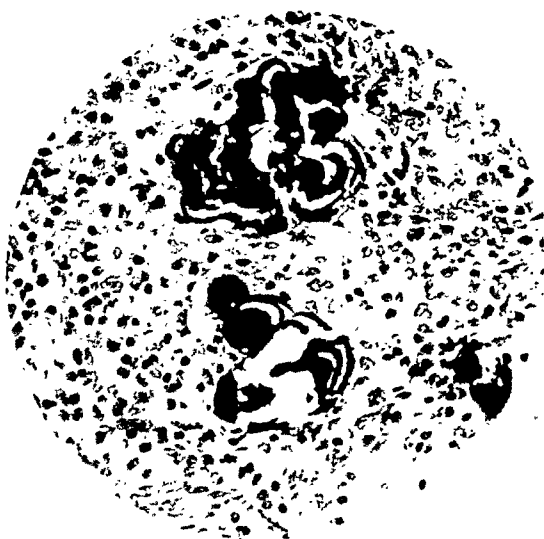


Fig. 5.—Section passing through the body and extremity of *Oxyuris vermicularis* in the submucous stroma of oviduct.

brief duration of the subjective symptoms. It is unusual that such pronounced pathologic changes should occur in an apparently healthy young woman without earlier and more pronounced subjective symptoms and with such insignificant menstrual disturbance. The conditions in the adnexa were unquestionably of long duration as the

density and toughness of the adhesions would indicate. In all probability, the torsion of the oviduct began before the pyosalpinx reached such massive proportions and became more exaggerated as the size increased.

Casagrande<sup>1</sup> has recently reported a case of torsion of the oviduct and cites the work of Darnell, Anspach, Payr and Smith and Butler to show that torsion of a normal tube is of rather rare occurrence, whereas in pathologic tubes it is relatively more common.

Finding the nematode worm and the fairly distinctive reaction induced by the parasite, prompted us to refer to the literature relative to the subject. The last case of *Oxyuris* in the oviduct was reported by Tschamer<sup>2</sup> in 1919. He gives a review of the literature for many years previous to that time and includes an extensive list of references. He describes his own case of *Oxyuris* in the tube, refers to that of Schneider<sup>3</sup> in 1902 and of Giovanni Marro<sup>4</sup> in 1901.

Tschamer states that *Oxyuris* is not an entirely harmless parasite, being able to penetrate the wall of the intestine, to cause appendicitis and to induce inflammatory changes in the tissues in which it lodges. The worms have been frequently observed in the female genital tract, wandering into the cervix, uterus, and tubes. He thinks the condition is more common than the reported cases would indicate. He cites the case of Simmons in 1899 in which the parasites were found in the cervical secretion, and that of Chiari in which they were found in a sacule in the wall of the pouch of Douglas.

In Tschamer's case the uterus was completely removed on account of a cervical chorioepithelioma and the *Oxyuris* was found free in the lumen of the tube by the pathologist.

Schneider removed the whole uterus in his case on account of a bilateral pyosalpinx. The patient died of peritonitis, and a nodule 2 mm. in diameter was found in the stump of the ovario-pelvic ligament at autopsy. The nodule was found to contain an adult, female *Oxyuris* and innumerable ova.

Giovanni Marro discovered *Oxyuris* in the wall of a tube at autopsy but no statement was made as to the cause of the individual's death. Here again, a nodule was found on the surface of the oviduct and the *Oxyuris* was identified in the nodule, microscopically.

Rheindorff<sup>5</sup> believes *Oxyuris* requires blood for its existence and that it penetrates the mucosa in quest of food.

Tschamer accepts Merten's<sup>6</sup> idea that *Oxyuris* carries pathogenic bacteria with it, and that these may provoke ascending, inflammatory processes. He rejects Simmon's proposal of a parasitic endometritis, *sui generis*, caused by *Oxyuris*. He regards salpingitis due to this cause as very unusual and concludes that it should not be considered as a pathologic entity. He publishes his case as a rare, medical curiosity.

We are inclined to regard the changes produced in the oviduct as quite analogous to those produced by the tubercle bacillus in the same organ. The histologic changes in the tube are clearly of a type attributable to a weak injurious agent and assumption of secondary bacterial infection does not appear necessary.

It is quite likely that the condition has been confused with tuberculosis of the oviduct as the histology in some areas is sufficiently similar to render this error readily possible.

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370 WASHINGTON AVENUE.

(For discussion, see page 290.)

## TORSION OF THE FALLOPIAN TUBE, WITH THE REPORT OF A CASE PRODUCING ACUTE GANGRENE OF THE TUBE

BY MARION DOUGLASS, M.D., CLEVELAND, OHIO

(From the Department of Gynecology, Western Reserve University School of Medicine, and The Lakeside Hospital)

**T**ORSION of the fallopian tube which has already become the site of some preexisting lesion is not an extremely uncommon occurrence. The fact, however, that this condition is practically never diagnosed clinically, justifies consideration of this case.

Primary torsion of a normal tube is an extremely rare condition and a consideration of tubal structure and attachments would suggest that in all cases in which this accident occurs there is an underlying pathologic factor. (Thorek.) It is often very difficult to be certain after torsion has occurred whether or not the tube was entirely normal previously. Hematosalpinx is the common finding in cases in which torsion takes place and it is impossible in many cases to assure one's self that the hematosalpinx found at operation was not a preexisting hydrosalpinx, as true in this case.

Darner was able to find six authentic cases only of torsion of an unquestionably normal tube. The lesion was described by Bland-Sutton in 1891. Anspach collected 95 cases, most of which showed an inflammatory tubal lesion as an associated factor, and which probably should be construed as the inciting cause of the disease.

Our own case was undiagnosed as there was nothing in the clinical history except the very acute character of the pain which suggested any other lesion than acute salpingitis.

Mrs. D. K., aged thirty-five, para iii, entered the Lakeside Hospital on July 22, 1927, complaining of pain in the lower abdomen which had gradually increased over a period of three days. The patient had one child, aged seventeen years, living and well. She had had two miscarriages, one preceding and one immediately following the birth of her child. She had had a single attack of appendicitis and had an appendectomy in 1917. Her past history was otherwise entirely negative.

Her present illness began two weeks before her admission with cramp-like pains in the right lower quadrant and in the midline. She also had marked backache.

She had severe chills and felt feverish. The pain becoming tremendously acute and lancinating the day before admission, she was admitted to the accident ward, fourteen days after the beginning of her illness.

Her menstrual periods were normal and she had profuse leucorrhea. Physical examination was negative except for the abdomen which was markedly tender in the right lower quadrant, and on pelvic examination there were bilateral adnexal masses. Her temperature on admission was  $38.5^{\circ}$ . W.B.C. count was 14,000. Urine examination was negative. The diagnosis was acute exacerbation of a chronic salpingitis. The patient was treated expectantly for eight days, after which her temperature was normal and W.B.C. count was 10,000. On pelvic examination at this time there was found a relaxed outlet and there was marked leucorrhea

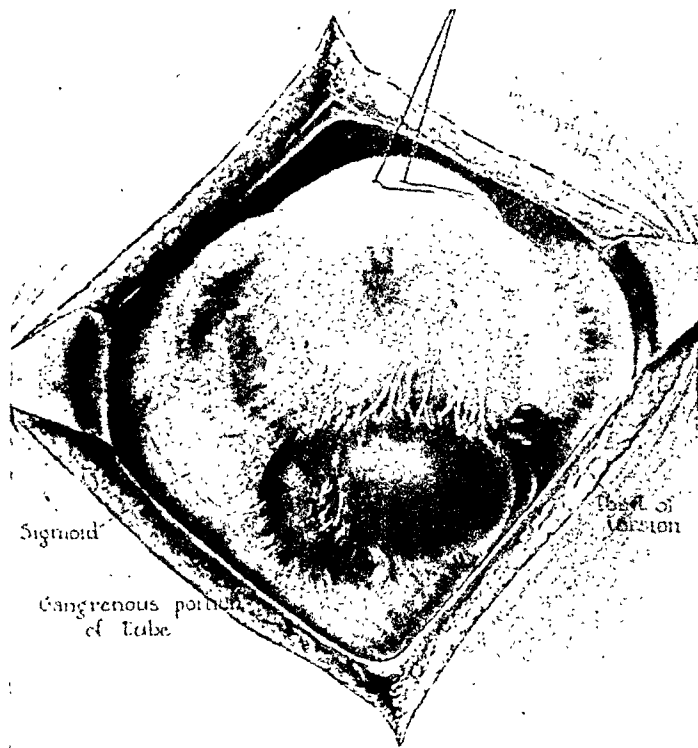


FIG. 1.

The cervix was lacerated. The uterus was anterior, about normal in size and hard. There was a large, soft, cystic mass, suggesting a hydrosalpinx, posterior to the uterus and approximately the size of an orange.

Laparotomy was performed and the pelvis was found to be obscured by adhesions of the omentum which were separated and a large dark cystic structure was found posterior to the uterus filling the entire culdesac. This was finally identified as being the right tube. The mass was apparently gangrenous, it being dark red, and in various areas entirely black. The tube was gradually freed by careful sharp dissection and the adhesions to the sigmoid and the bottom of the culdesac separated slowly. The left tube was closed at the fimbriated end and filled with seropurulent fluid. Smear showed a mixed infection of streptococci and bacilli.

We were unable to account for the dark color and gangrenous appearance of the right tube until after removal of the adherent omentum, examination showed that the tube was twisted three times upon itself, almost having twisted itself off at a point almost at the junction of the proximal and middle thirds. This was

obviously the cause of a moist gangrene. A hydrosalpinx had become twisted upon itself several times and became necrotic, forming adhesions in the pelvis in every direction. The fimbriae were destroyed and the tubal end sealed off completely. Infection was as yet limited to the immediate vicinity of the tube. Micropathologic diagnosis showed acute necrosis of the right tube with total loss of structure. The lumen was filled with blood clot and the endosalpinx was entirely destroyed. The left tube was thickened and the fimbriae were closed off. The wall was thickened and edematous and was infiltrated with polymorphonuclear and mononuclear leucocytes. The mucosa was practically intact. The diagnosis was acute exacerbation of a chronic salpingitis. The ovaries were uninvolved and were normal in size and appearance.

The fallopian tube may be considered as predisposed to torsion, due to its position. Having a fixed medial extremity and a lax attachment to the broad ligament and an enlarged fimbriated end, it tends to fall posteriorly and rotate medially which gives it a primary twist which often amounts to 90° rotation. Changes in abdominal pressure incident to defecation, coughing, etc., are constantly changing the position of the tube and may produce temporary torsion. Pregnancy with its attendant changes in abdominal topography is undoubtedly a predisposing factor. It is quite probable that menstruation, with its increase in congestion, plays a part as an attendant cause. The influence of stasis and venous congestion as a cause for torsion has been emphasized by Payr. He holds that venous stasis causes pressure changes in the pedicle which may produce torsion of a viscus. The size and number of veins in the mesosalpinx and the frequency of swelling and congestive changes in the adnexa due to uterine prolapse or misplacement, causing partial obstruction of these thin-walled vessels, makes this seem plausible. External violence and blows on the abdomen have been reported as preceding the acute abdominal attack which proved at operation to be acute torsion of the tube but their influence is somewhat problematical. Anatomic anomalies such as an abnormally long mesosalpinx or enlarged hydatids of Morgagni may reasonably be responsible for preventing a tube which has been kinked or twisted from freeing itself by acting as a mechanical drag or impediment to the normal mobility of the tube. Darner emphasizes the importance of rhythmic contractions of the tube which may possibly produce the conditions necessary to torsion by changes in venous pressure.

The fact that in all reported cases the incidence on the right side is approximately three times greater than on the left is due either to the fact that the right side of the pelvis is more roomy, due to the location of the sigmoid on the left, which allows greater mobility, or that the adjacent appendix helps produce the inflammatory changes and light adhesions which predispose to the accident. The initial symptoms are usually violent with severe pain and shock resembling those of ovarian cyst with a twisted pedicle, and where the twist is complete, there

may be all the symptoms of a general peritonitis except that the subjective features, i.e., pain and abdominal distress are out of proportion to the temperature and pulse rate. Differential diagnosis must attempt to exclude all the other acute abdominal conditions.

If the condition is undiagnosed, the tube may disengage itself and the acute symptoms rapidly disappear. The hematosalpinx may, however, rupture, producing dangerous intraabdominal hemorrhage. Necrosis, gangrene, and infection are always likely to occur with the production of a general peritonitis. An absolute diagnosis is impossible in the great majority of cases even after the induction of anesthesia, but inasmuch as the confusing conditions usually call for prompt operation the patient will rarely be subjected to unwarranted surgical therapy. As emphasized by Darner, the opposite tube should be carefully scrutinized where one seems to be involved only, because the predisposing etiologic factors are probably bilateral in distribution.

It seems likely that this patient had a hydrosalpinx which became twisted and because of its unwieldy club-shaped end was unable to disengage itself before engorgement gangrene and necrosis occurred. Had the intensity and violence of the abdominal pain as a dominating symptom received due attention, the condition might have been at least suspected.

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1235 LAKESIDE AVENUE.

## OSTEOGENESIS IMPERFECTA CONGENITA\*

BY CHARLES A. GORDON, M.D., F.A.C.S., BROOKLYN, N. Y.

THIS case of osteogenesis imperfecta congenita is reported because of its rarity and the importance of adding photographs, roentgenograms and tissue reports to the literature. Lovett and Nichols have rejected many cases reported as true cases, but since the introduction of the x-ray, diagnosis has become more certain.

Often improperly called fragilitas ossium, its essential feature is bony fragility with numerous fractures and bendings of the long bones, excessive callus formation, and consequent shortening and alterations in contour.

The presence of preparative changes and indisputable evidence of callus formation is excellent proof of intrauterine fracture. The child



Fig. 1.—Osteogenesis imperfecta congenita showing narrow chest, large abdomen and short legs with angles of deformity.

is usually stillborn, or dies shortly after birth, but often it lives suffering repeated spontaneous fractures. This tendency may persist through life; or disappear after many years. Treatment has been of no avail.

Its etiology is unknown. Endocrine disturbance is thought by some to be the cause, but this is a pure hypothesis although the pituitary seems to influence interstitial growth of bone. In some cases it is familial and apparently hereditary. Syphilis and rickets are not thought to be factors. Blood chemistry studies attempting to establish calcium deficiency have not shown anything of value. It is said that amniotic bands or adhesions or severe trauma late in pregnancy are factors.

Its pathology, too, is not clearly understood. It is a fact, however, that diaphyseal cartilage is but a preliminary step in bone formation. Ossification of the shaft follows division of cartilage cells which are set free as osteoblasts by absorption of the cartilage envelope; rapid

\*Read before the Brooklyn Gynecological Society, November 4, 1927.

proliferation of these cells results in ossification. In osteopenesis imperfecta bone formation remains in a primary fibrous state. Briefly, there is either a failure on the part of the osteoblasts to form periosteal bone, although cartilage calcification and bone absorption may be normal, or the normal ratio of absorption and bone formation is lost. Osteoporosis is secondary, and results from excessive formation of medullary spaces. The cartilage itself is not materially altered.

Baby D., male, born in the Greenpoint Hospital on October 9, 1927. Its parents were in good health with no evidence of acute or chronic disease or trauma, and there were six other children living and well.

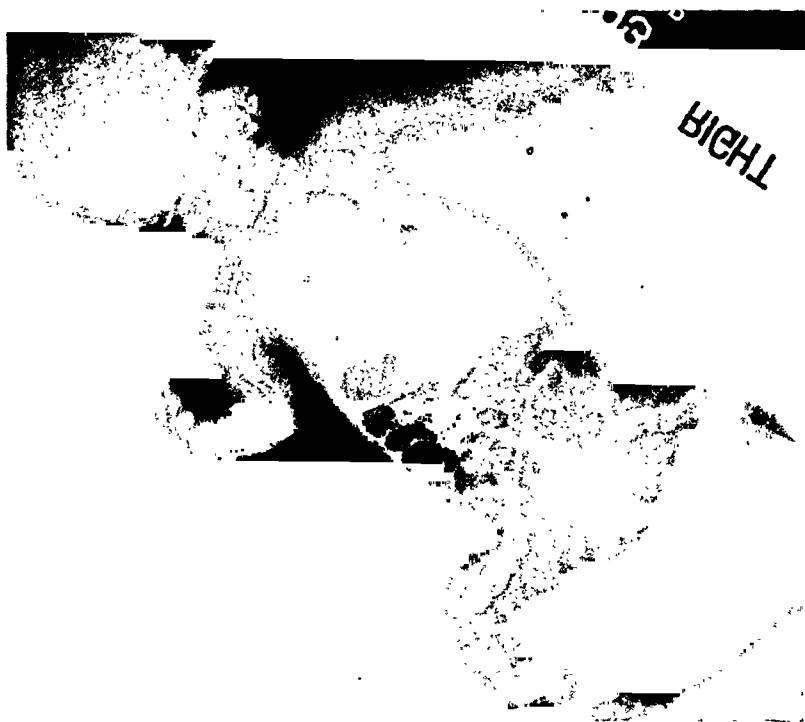


Fig. 2.—Roentgenogram of same fetus, showing fractures of both humeri, left clavicle, and left tibia. Both femurs show marked alterations in contour.

The mother was thirty-two years of age, with no history of miscarriages, and the course of all her pregnancies had been normal. At term she was delivered of a breech spontaneously without assistance.

The urine was normal, Wassermann negative, and blood pressure was 116/68. Blood count showed 5,500,000 R. B. C., with normal morphology.

The baby weighed 2400 gm., and cried at birth. Its color was poor, the head large with a great abundance of hair, with increased bitemporal diameter, and low implantation of the ears which were turned downward and outward. The cranial vault consisted only of scalp with scattered islands of bone, which crackled on touch. There were no sutures, no fontanelles and no evidence of molding. The torso seemed normal. Both upper and lower extremities were short, bowed and deformed, the lower extremities much shorter than the trunk, and bony crepitations were felt immediately after birth. The baby lived thirteen hours, and during this time no movement of the arms was observed.

Roentgenogram showed fractures of left clavicle, of both humeri, and the right radius, with marked shortening, bowing and alterations in contour of both femurs



and both tibiae and fibulae. The vault of the skull showed defective ossification and the thoracic cage was small with shortened ribs irregular in outline; spine and pelvis were normal. Only one large plate showing the entire fetus was taken.

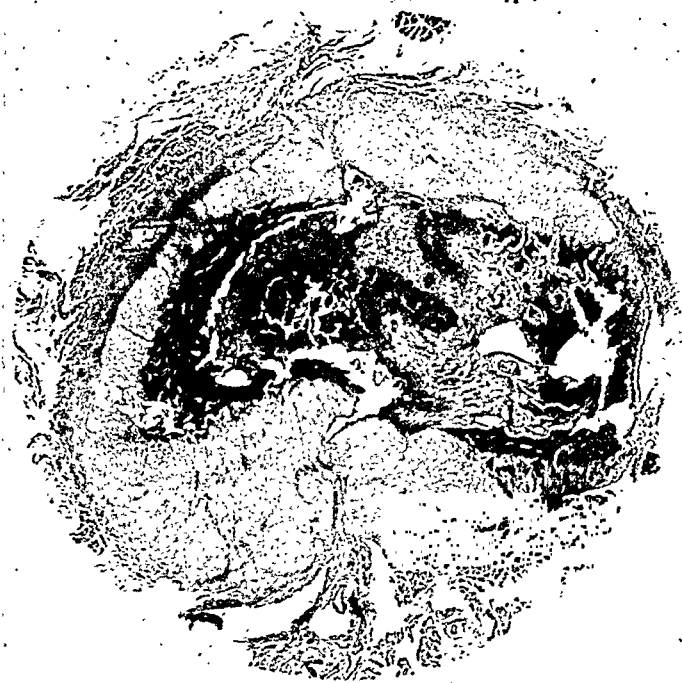


Fig. 3.—Transverse section of diaphysis of left humerus, decalcified, 8 microns thick. Stained in hematoxylin and eosin. Low power. The periosteum is much thicker than normal, and shows reaction to fracture at thickest points. Periosteal buds are seen. Normal layer of compact subperiosteal bone is missing. Marrow cells are abundant in the center. Bulk of section shows subperiosteal cartilage.

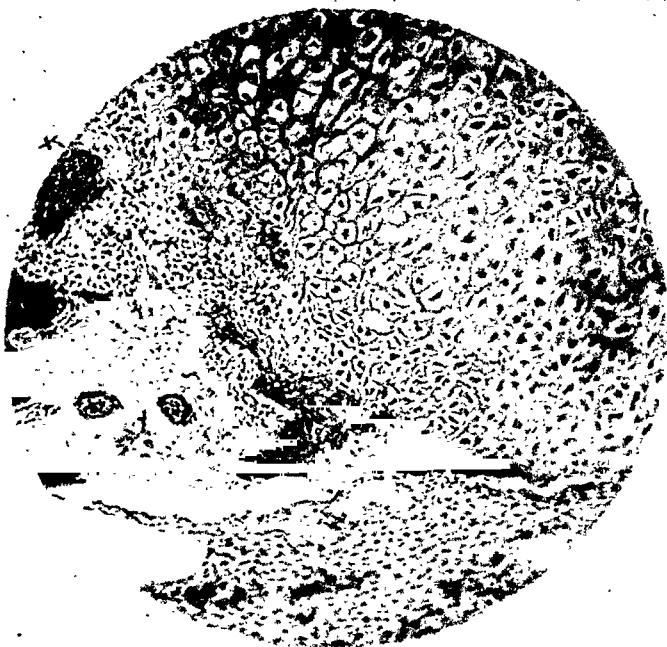


Fig. 4.—Area from Fig. 3, magnification 210 diameters. Fairly well ossified trabecula with area just above it showing blood vessel, increased cartilage matrix with deposit of calcium salts being surrounded by osteogenetic tissue, a calcification center in the cartilage.

A postmortem examination was made six hours after death by Dr. E. H. Nidish. The head was large, easily compressed, thickly covered with hair, bitemporal diameter increased, ears low, cranial vault composed of scalp with limited circular osseous deposits. Chest narrow, abdomen large, arms and legs short and curved, with callous masses and crepitations readily felt. Stump of umbilical cord dry and clear. Brain soft and pale.

The heart was small with thickening of mitral, aortic and tricuspid valves, foramen ovale patent, and ductus arteriosus closed. Thymus normal in size. Lungs normal except for some subpleural ecchymosis in lower lobe. The left clavicle was fractured and thirty-one fractures were found in the ribs.



Fig. 5.—Area from Fig. 3, magnification 210 diameters. Many trabeculae of spongy bone, well covered with osteogenetic tissue pushing its way through the cartilage.

No gross or microscopic changes noted in gastrointestinal tract, liver, spleen, or kidneys.

The long bones were gray in appearance, easily bent and seemed soft and flexible. One humerus was broken during its removal. All the long bones were shortened, thickened and bowed with irregular surface, marks of callus rings.

A cross-section of diaphysis of humerus measured 8 mm. (normal 5 mm.) while the epiphyses were about normal. The marrow cavity measured  $5\frac{1}{2}$  mm. (normal 3 mm.). Periosteum thickened and periosteal buds seen here and there. Normal layer of circumferential compact subperiosteal bone absent. Bulk of section shows embryonal cartilage with vacuolization of cells. Trabeculae spongy with osteogenetic tissue very well developed in some areas, with large numbers of osteoblasts. Osteoclasts were scarce. Calcification centers were seen in the cartilage. Close contact of muscle with periosteum.

#### SUMMARY

1. Muscular action on cartilage probably accounts for the deformity of bone, and may increase the size of the marrow cavity.

2. Failure of subperiosteal bone formation, with marked decrease in the number of trabeculae, and persistence of embryonal cartilage constitute the essential lesion.

3. No evidence of disproportionate breaking down of bone was seen.

4. If any conclusion were to be drawn from this isolated study, it would seem that the condition is due either to defective function of the osteoblasts or possibly lack of sufficient preparatory calcification of cartilage.

(For discussion, see page 293.)

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## ECTOPIC CORPORA LUTEA\*

BY VERA B. DOLGOPOL, M.D., NEW YORK, N. Y.

(From the Pathologic Laboratory of the Flower Hospital, New York, N. Y.)

THE corpus luteum in the past twenty-five years has been the subject of extensive morphologic, physiologic, and pathologic investigations. Most authors have studied the corpus luteum either as an independent unit or in relation to its influence on the uterus and on the ovum. Very little consideration has been given to its relation to the ovary of which it is normally a part.

The corpus luteum is intimately connected with the ovarian stroma. The stroma undergoes certain changes during the growth and rupture of the graafian follicle and also during the maturation and regression of the corpus luteum. The corpus albicans, after the organization is completed, becomes a part of the ovarian stroma.

Under pathologic conditions the connection of the corpus luteum with the ovarian structures may become less intimate, resulting in a partial or complete displacement of the corpus luteum as a whole from its intraovarian bed. The displacements of the corpus luteum have been studied chiefly by European investigators, but, from the review of English literature, I conclude they have received little or no attention in either England or America.

The pathologic changes and processes affecting the corpus luteum include the *hematoma*, the *cystic changes*, the *infections*, and the *neoplasms*. These conditions have been studied by the German school (especially by E. and L. Fraenkel, Halban, Orthmann, Pfannenstiel, and others) and by Ewing and Novak in this country. Little attention has been given in several résumés of the pathology of the corpus luteum to the topographic changes which form the subject of this paper and the pathologic significance of which is only slightly known.

In human ovaries the corpus luteum is, as a rule, embedded in the substance of the ovary. In early stages of its development the corpus

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\*I wish to thank Dr. William E. Youland for his valuable help in preparation of this paper.

luteum may be seen as a vascular body situated immediately beneath the tunica albuginea and slightly bulging over the surface of the ovary. Usually the corpus luteum may be distinguished only by the point of follicular rupture which may be patent, with a small amount of "lutein" tissue protruding through it, or occluded and vascularized. In later stages the corpus luteum is often revealed only on sectioning the ovary.

Under pathologic conditions the corpus luteum may be partially or completely *extruded* from the ovary, occasionally assuming an extra-ovarian position. In reviewing the literature 24 cases of this anomaly could be found, chiefly in the German and Russian literature. As mentioned previously, no articles or case reports dealing with this anomaly could be found in the English or in the American literature.

In 1898 Stratz described in an ape a recent corpus luteum which was fully everted outside of the ovary, forming a mushroom-like structure with a pedicle consisting of the ovarian tissue.

In 1899 Schnell found a corpus luteum protruding through a defect in the tunica albuginea and connected with the ovary only in a small portion of its surface.

In 1901 Lefas described an "aberrant" corpus luteum attached to the fimbriae of the fallopian tube, and Gruzdeff reported a case of "complete prolapse" of the corpus luteum.

Twenty-one more cases of partial or complete separation of the corpus luteum from the ovary have been described by Lwoff, Luppoff, Schroeder, O. Frankl, Stolper, Matsuno, and Mandelstamm.

Some textbooks (Gebhard, Pfannenstiehl) mention the separation of the corpus luteum as a rare anomaly.

Although only 24 cases of this anomaly have been published in twenty-eight years, the surgical material of the Flower Hospital of New York has offered the opportunity of seeing 2 cases of pedunculated corpora lutea and a number of transitional forms in a short period of five months (the 2 cases of pedunculated corpora lutea occurred within two days). In addition several more examples of topographically atypical corpora lutea which are not included in this report have been met with in this laboratory. It would appear that this anomaly is not uncommon.

#### CASE REPORTS

CASE 1.—M. R., thirty years old, married; operation of uterine suspension with removal of inflamed adnexa. Menstruation every twenty-eight days. Last period Nov. 1. Operation Nov. 26. Vaginal bleeding, moderate, on Nov. 28. The following period Dec. 28.

*Gross Description:* The ovary (Fig. 1) consists of two parts. The larger part is pale and wrinkled and measures 4.5 by 2.5 by 1 cm. The smaller part is brownish-yellow in color, with smooth surface, and measures 1.3 by 1.5 by 1 cm. The larger portion of the ovary contains a number of small follicular cysts and presents a

deep notch on its outer pole. A linear slit leads from the notch into a collapsed cavity 1.2 cm. deep, with rough vascular walls. No blood clots present in the cavity. The tunica albuginea of the ovary bridges over from the brim of the slit to the smaller portion of the ovary, in the form of a thin, flat pedicle. The smaller portion of the ovary which is freely movable on its pedicle presents a corpus luteum in the stage of maturity, with a distinct stigma.

*Microscopic:* The section through the corpus luteum presents a menstrual corpus luteum in the stage of maturity. The section through the collapsed cavity (Fig. 2) shows a slit in the loose, somewhat edematous connective tissue surrounded by a number of hyalinized blood vessels, a few small follicular cysts, a few corpora albicantia and fibrosa. Several of the smaller blood vessels are torn, allowing a small amount of blood to escape into the loose connective tissue and on the surface of the cavity. No signs of repair around the slit.

*Diagnosis:* Pedunculated corpus luteum of menstruation, third period; escape occurred shortly before the operation or during the operation.

CASE 2.—S. F., thirty years old, married. Removal of the left ovary and resection of the right ovary. Menstruation regular.

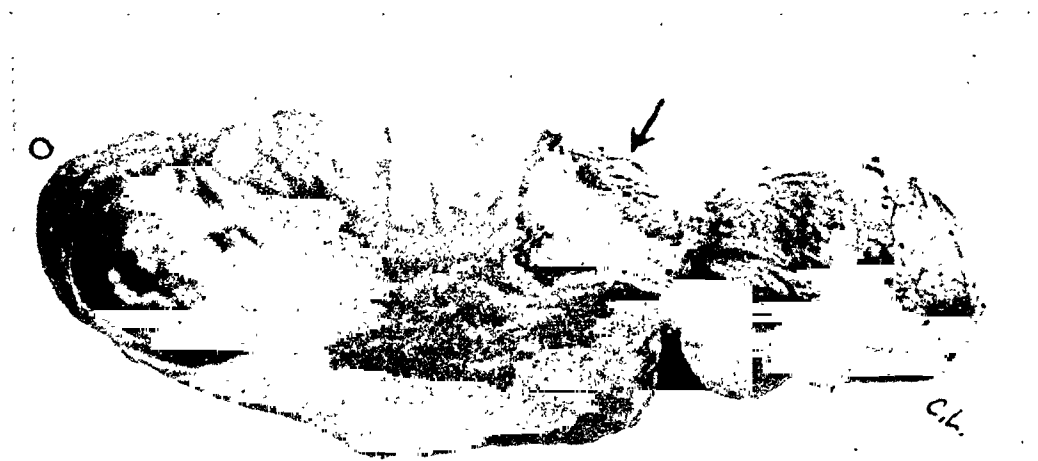


Fig. 1.—Case I. Pedunculated corpus luteum. O, ovary; C.L., corpus luteum. The arrow touches the brim of the cavity. The cavity, previously collapsed, was distended by means of a piece of glass rod.

*Gross Description:* The left ovary (Fig. 3) consists of two parts. The larger part is pale and wrinkled and measures 3 by 1.5 by 1.7 cm. The smaller part is reddish in color, irregularly ovoid in shape, and measures 2 cm. in length and 1.5 cm. in diameter. The two portions are connected by means of a thin, flat, wrinkled isthmus continuous with the tunica albuginea and arising from the brim of a shallow depression on the surface of the ovary.

*Microscopic:* The surface of the notch is covered with fibrin invaded with a large number of fibroblasts and new blood vessels. A large corpus albicans is situated below the area undergoing organization. The remainder of the ovary presents considerable fibrosis and contains a number of ripening follicles and a few small follicular cysts. The smaller portion of the ovary consists of a corpus luteum in the stage of maturity.

*Diagnosis:* Pedunculated corpus luteum of menstruation, third period.

In neither of these two cases has the displacement of the corpus luteum been noticed by the surgeons.

CASE 3.—F. S., thirty-two years old, married. Removal of a uterine polyp, of the lacerated cervix and of a cystic ovary.

*Gross Description:* The ovary (Fig. 4) measures 5 by 2.5 by 2 cm. The surface is pale and smooth. A few small translucent cysts are seen beneath the tunica albuginea. A large, soft corpus luteum protrudes through a slit in the tunica albuginea with about one-third of its surface. On section the corpus luteum is conoid in shape, with the apex in the slit.

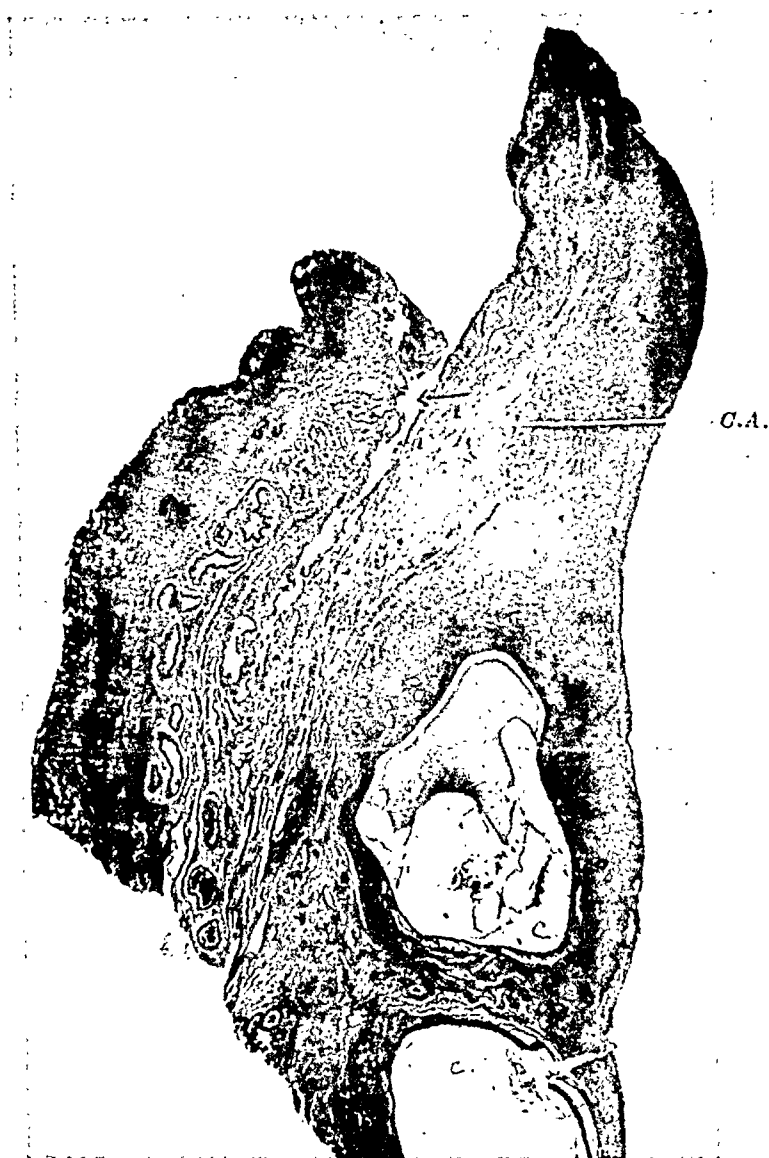


Fig. 2.—Case I. Section through the collapsed cavity (low power). *b.v.*, blood vessels; *C*, follicular cysts; *C.A.*, corpus albicans. The arrow points out the collapsed cavity left after the escape of the corpus luteum.

*Microscopic:* The stroma near the slit is edematous, the tunica albuginea recedes from the corpus luteum. The corpus luteum is in the stage of proliferation.

*Diagnosis:* Corpus luteum in the end of the first stage; beginning expulsion.

CASE 4.—I. B., thirty-nine years old, married. Ventrosuspension and removal of adnexa (cystic ovaries).

*Gross Description:* The ovary (Fig. 5) measures 4 by 3 by 1.5 cm. A round, brownish body 1.5 cm. in diameter is situated on the upper pole of the ovary,

being embedded in the ovarian stroma with about one-quarter of its surface. A deep groove separates the body from the main mass of the ovary. On section the body proves to be a corpus luteum in an early stage of development. The ovarian stroma is fibrosed and contains a few follicular cysts.

*Microscopic:* The stroma presents fibrosis and cyst formation. The corpus luteum, in the end of the first or in the beginning of the second stage of its development, is surrounded by a narrow strip of the ovarian stroma which is thinnest at its pole. The germinative epithelia dip into the groove mentioned above and ascend to about one-half of the corpus luteum.

*Diagnosis:* Polypoid corpus luteum.

CASE 5.—R. L., Forty-three years old, married. Metrorrhagia; oophorectomy.

*Gross Description:* The ovary measures 3 by 1.5 by 1.2 cm. Almost one-half of the ovary is occupied by a flattened corpus luteum, constricted by means of a groove from the rest of the ovary. The stigma of follicular rupture is situated on the side of the corpus luteum.

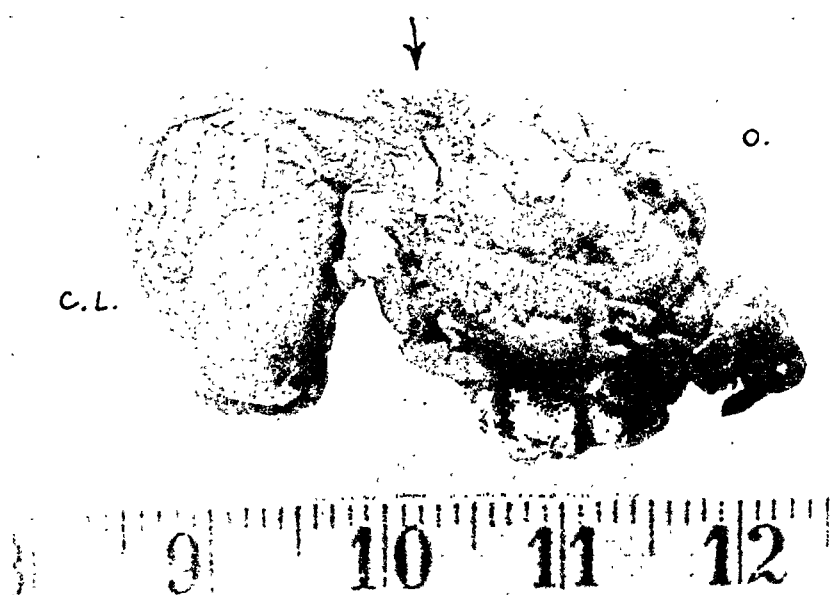


Fig. 3.—Case II. Pedunculated corpus luteum. O, ovary; C.L., corpus luteum. The arrow points out the depression with an elevated brim, the former site of the corpus luteum.

*Microscopic:* The stroma contains numerous corpora albicantia, some of which are situated immediately beneath the germinative epithelia. The corpus luteum is in the first stage of its development. The germinative epithelia cover a small portion of the corpus.

*Diagnosis:* Polypoid corpus luteum.

CASE 6.—C. S., forty-five years old, married. Metrorrhagia; myomectomy.

*Gross Description:* Left ovary measures 5 by 4.5 by 2 cm. On the upper pole of the ovary a corpus luteum with a congested stigma is constricted from the main mass of the ovary, together with a small portion of the ovarian tissue. The stigma is situated on the side of the corpus luteum. A follicular cyst, filled with gelatinous material, is situated beneath the corpus luteum.

*Microscopic:* Corpus luteum of menstruation in the second stage of its development, surrounded by a small amount of ovarian stroma.

*Diagnosis:* Polypoid corpus luteum.

The corpora lutea of the first 2 cases belong to the pedunculated variety and are almost identical with the 2 cases of incomplete prolapse, described by Lwoff. Cases 4, 5, and 6 belong to the polypoid corpora lutea described by Luppoff and Schroeder. Case 1 presents a recent corpus luteum which escaped from the congested and edematous ovarian stroma surrounded at a distance by resistant structures (corpora albicantia, hyalinized blood vessels, follicular cysts). The escape must have taken place shortly before the removal of the ovary, as there is no indication of beginning organization of the collapsed



Fig. 4.—Case III. A corpus luteum partially expelled through the "stigma." C.L., corpus luteum; S, salpinx.

cavity. In the second case the corpus luteum must have escaped from the ovarian stroma much earlier than in the first cases, judging from small dimensions and shallowness of the former site of the corpus luteum and from advanced organization on the surface of the depression. Both ovaries present considerable fibrosis and cyst formation. The third case presents a corpus luteum in an early stage of expulsion, impacted in the weak spot of the tunica albuginea corresponding to the place of follicular rupture. In Cases 4, 5, and 6 the corpora lutea



are situated more superficially than in Case 3. In Case 4 the ovarian stroma receded from three-quarters of the surface of the corpus luteum; in Case 5 more than one-half of the corpus protrudes over the surface of the ovary; in Case 6 the entire corpus luteum with a small portion of the ovarian stroma is being constricted from the main mass of the ovary. In Cases 4 and 6 follicular cysts are situated in the closest proximity of the base of the corpus luteum, the remainder of



Fig. 5.—Case IV. Polypoid corpus luteum. The ovary has been sectioned and opened "like a book." C.L., corpus luteum; S, salpinx.

the stroma presenting a considerable degree of fibrosis. In Case 5 the fibrosis is very extensive.

In analyzing different forms of partial and complete separation of the corpora lutea, published previously and described above, one feature common to all of them can be noticed, namely, the *displacement* of the corpora lutea from their intraovarian site toward the periphery. Until the present time there has been much confusion about the terminology of this anomaly. With 24 cases previously published at least four different names have been used, some of them being used in a

different sense. The term "ectropium" (Gebhard), which can be applied only to everted corpora lutea is used by Strakosch to designate the small hernia-like protrusion of the "lutein" tissue frequently seen around the stigma. The "aberrant corpus luteum" does not include the incomplete separation. "Prolapse," the name used by most German and Russian authors, seems to be the most popular, but Frankl uses it only for everted corpora lutea, applying the term "expulsion" to all other forms of separation of the corpus luteum. Most of these terms attempt to combine the anatomic conception with the explanation of the pathologic mechanism. As the mechanism is not always the same, none of the above mentioned terms can be satisfactorily applied to all known cases.

The term "ectopic corpora lutea" is here proposed since the condition primarily is a *displacement* of the corpus luteum from its intra-ovarian bed to a degree not present in the topographic relations of the normal corpus. This term is definitive and permits the subdivision allowing the inclusion of various cases reported.

Three forms of ectopic corpora lutea may be distinguished:

1. Polypoid corpora lutea,
2. Pedunculated corpora lutea,
  - a. everted,
  - b. noneverted,
3. Free corpora lutea.

The *polypoid* corpora lutea are elevated above the surface of the ovary being connected with it by less than one-half of their surface. A deep groove corresponding to the place of retraction of the ovarian stroma constricts the corpus luteum from the ovary. The tunica albuginea covers the corpus luteum as a thin avascular membrane which is thinnest at its pole. The stigma is located on the lateral aspect of the corpus luteum. The germinative (Waldeyer's) epithelia covering the surface of the ovary dip into the groove and ascend to a certain height on the bulging corpus luteum, gradually becoming flat, and disappearing on the pole of the corpus luteum. The polypoid corpora lutea become superficial corpora albicantia. There is no indication as to the possibility of further separation of polypoid corpora lutea, except, perhaps, in cases of gradual expulsion by progressively growing massive cysts. The polypoid corpus lutea are seen quite frequently. Four corpora lutea of this variety have been described by Schnell, Luppoff, and Schroeder; three have been described here.

The *pedunculated* corpora lutea may be everted and noneverted. In the everted form the pedicle consists of the ovarian stroma which may contain follicles. The theca externa forms the innermost layer of such corpus, the inner connective-tissue layer forms the outer covering. Two cases of this variety are known (Stratz, Frankl).

In the noneverted form the pedicle consists of a flat, thin piece of the tunica albuginea arising from the border of a depression on the surface of the ovary. The depression is deep in recent cases and shallow in older cases. The corpus luteum is invested in all its coats and is surrounded by a narrow zone of connective tissue which may be followed through to the tunica albuginea of the pedicle. Two cases of this type have been described by Lwoff and two were seen in our laboratory. The noneverted pedunculated corpora lutea probably become completely separated from the ovary.

The *free* corpora lutea ("corpora libera" of Luppoff) may arise either by gradual liberation of pedunculated forms or by complete expulsion of the corpora lutea not having any firm connections with the ovarian stroma at the time of separation. The free corpora lutea have been found altogether free in the sac of Douglas, or implanted on the peritoneum of the sac of Douglas, of the uterus, salpinx, etc., by means of a newly formed fibrous pedicle. They were found also loosely connected by means of fibrin to the intact surface of the ovary. The free corpora lutea vary in their dimensions from the size of a normal corpus to small shrunken bodies described by Lwoff as "size of a cherry pit." They are usually covered with both thecae. Occasionally the theca externa or both thecae are absent, so that the granulosa forms the outer layer of the free corpus. In old organized corpora lutea the microscopic examination is necessary to identify the corpus by an old central blood clot surrounded by a festooned layer of connective tissue with a straight layer of connective tissue on the periphery. Implanted corpora lutea show the greatest degree of organization in the portion nearest to the newly formed pedicle. The final fate of a free corpus luteum is most probably resorption, which may require a very long time (as in a case of Luppoff's). Sixteen cases of free corpora lutea have been reported in the literature (Lefas, Gruzdeff, Lwoff, Luppoff, Frankl, Stolper, Matsuno, Mandelstamm).

The few extraovarian corpora lutea examined as to their nature and stage of development proved to be menstrual corpora lutea in the second or third period of their cycle. Both pedunculated corpora lutea presented here were menstrual corpora lutea in the stage of maturity.

Two causes, usually referred to as giving rise to ectopic corpora lutea, are: *sudden traumatic extrusion* by the surgeon during an operation or bimanual vaginal examination of the adnexa and *gradual expulsion* by progressively growing massive ovarian cysts. The superficial situation of the graafian follicle, delayed cicatrization of the stigma, large size of the corpus luteum, and increased vascularization of the ovarian stroma are mentioned as contributing factors.

Mechanically in all these conditions there is increased intra-ovarian pressure (for a short time, as in traumatic extrusion, or for a longer

time, as in progressively growing cysts) expelling the corpus luteum in direction of least resistance, toward the stigma which for a long time remains a weak spot on the surface of the ovary. Multiple follicular cysts and fibrosis of the ovary contribute to the superficial situation of the follicles and corpora lutea.

No pathologic importance has ever been attributed to polypoid corpora lutea, as they are still intimately connected with the ovary and undergo organization in the usual manner, merging finally with the ovarian stroma. The pathologic significance of the extraovarian forms is a matter of dispute.

The pedunculated corpora lutea were considered as a portal of entrance for ovarian infection (Schnell). The escape of a corpus luteum was considered as one of the causes of intraperitoneal hemorrhages (Schnell, Sarrouy and Duboucher). Free corpora lutea were regarded as a possible source for development of extraovarian "lutein" cysts. The possibility of infection through everted corpora lutea and through the ovarian defect, left after the escape of a corpus, is obvious. An intraperitoneal hemorrhage could be expected after the separation of the corpus luteum from the ovarian stroma, but in the cases where the escape occurred under the surgeons' observation the loss of blood was very small. Large hemorrhages from the corpus luteum are usually connected with its rupture or with an ovarian pregnancy. The possibility of extraovarian (or, perhaps, also "ectopic") cysts of ovarian origin may be considered in cases similar to those reported by Lwoff and Stropeni, although separation of previously formed cysts from the ovary is more probable.

In the present time the school of Halban is inclined to attribute to implanted and nonimplanted corpora lutea an endocrine rôle similar to that of "persistent corpora lutea" of the cattle, with an inhibiting influence on menstruation and ovulation. Stolper thinks that the removal of a free corpus luteum brought about the onset of menstruation in his patient. Matsuno attributes an amenorrhea of four months' duration in his patient to the inhibiting function of an implanted corpus luteum. Their opinion is opposed by Mandelstamm who, in reviewing the literature, does not find any cases where the amenorrhea, if present, could not be explained in some other way besides an inhibiting influence of ectopic corpora lutea. In the first case reported here the onset of menstruation after the removal of a pedunculated corpus luteum cannot be attributed to the removal, because the menstruation occurred on the expected date. The ovulation has not been disturbed in Stolper's patient who had two successive pregnancies, an intrauterine (resulting in an abortion) and a tubal, which occurred without a menstrual period between the pregnancies, in spite of a free corpus luteum present in the peritoneal cavity; from Stolper's gross description the corpus resembles a menstrual corpus luteum.

It is evident that the number of cases thoroughly studied both from the clinical and pathologic points of view is insufficient to draw any definite conclusions about the endocrine function of ectopic corpora lutea. It would be advisable to make a careful investigation of the preoperative and postoperative menstrual histories in all cases of ectopic corpora lutea. The nature of such corpora lutea should be recorded after gross and microscopic examination. The cases of amenorrhea, if any abdominal operation is performed, should be investigated for presence of ectopic corpora lutea. The relation between the removal of the corpora lutea and the menstruation may be established by surgeons, who frequently resect intraovarian corpora.

### CONCLUSIONS

Considering two cases of pedunculated corpora lutea and a few transitional forms in our surgical material within five months, and three ectopic corpora in one year in Lwoff's and in Luppoff's surgical practice, it seems that ectopic corpora lutea are not a very rare anomaly. No definite pathologic significance can be attributed to the ectopic corpora lutea at present. It is possible that the ectopic corpora lutea will be seen more often and more will be learned about their significance if the surgeons will be more familiar with the existence of this anomaly. The complete absence of information in the English literature on the subject discussed here, even if it proves to be of minor pathologic importance, seems to justify a review of cases already reported and presentation of additional cases.

### SUMMARY

1. Corpora lutea may become partially or totally separated from the ovary.
2. Twenty-four cases of this anomaly have been published previously in the European literature; six additional cases are presented, illustrating different degrees of "displacement."
3. The term "ectopic corpora lutea" is proposed for this anomaly.
4. The inhibiting influence of ectopic corpora lutea on menstruation and ovulation has not been definitely established and requires further clinical and pathologic observation.

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## LAPAROTRACHELOTOMY: AN ANALYTIC REPORT OF FORTY CONSECUTIVE OPERATIONS WITHOUT A DEATH\*

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LOW cervical cesarean section had gained considerable favor in European clinics in the decade just prior to the World War. In our country this type of operation was practically untried until after that epoch and is just beginning to be accepted, due to the favorable reports of Hirst, Polak and Beck, DeLee and a few others.

The series herein reported represents an analysis of forty consecutive low cervical operations over a period of five years performed by one of us (Stein). Twenty of these operations were performed on patients in the private practice of one obstetrician (S), an incidence of one in 22.6. This rather high incidence of section is justified, we believe, by the critical analysis of our indications, and by our results. There were no maternal deaths in this series, and all but one baby left the hospital alive. We believe that the low morbidity revealed in our analysis could have not been attained had other methods of delivery been employed, such as high forceps, version, pubiotomy and craniotomy. Furthermore, we feel certain that the same result would not have been possible with the classic cesarean section. Küstner, in a very superior monograph on cesarean section<sup>6</sup> discussed the indications and advantages of each of the four types of operation and showed that the results of the leading German obstetricians utilizing the transperitoneal cervical section were most favorable. Although slow to adopt a new method, gradually one American obstetric surgeon after another is abandoning the classic cesarean for laparotrachelotomy.

We were not at all favorably impressed by the first few operations of this type which we witnessed, but soon after employing the method

\*Read at a meeting of the Chicago Gynecological Society, December 16, 1927.

we were completely converted to it, and in consequence have not performed a single classic section since the beginning of this series. Since August, 1922, we have performed forty consecutive low cervical sections up to July, 1927. This represents twenty private cases, eight service (ward) cases and twelve patients referred or in consultation. A fetal roentgenogram was taken routinely before operation, with but few exceptions, to insure the presence of a normally formed baby.

*Advantages.*—The advantages of laparotrachelotomy over the classic and extraperitoneal sections have been concisely stated by DeLee<sup>1</sup> who has studied a large series of operations in the Chicago Lying-In Hospital, representing the work of twenty operators under his direction. This group consists entirely of practicing obstetricians and obstetric specialists, and *not general surgeons*. We believe that this fact, coupled with the close supervision by Dr. DeLee, accounts for the splendid results obtained in their series. We feel that this method is superior to other types of cesarean section considering the various indications and the time of performance. The method recently described by Brodhead, Langrock and Cassasa<sup>2</sup> while proving safe from peritonitis was nevertheless attended by a 3 per cent maternal mortality from hemorrhage.

One cannot erase from memory Newell's startling report in 1917 of the horrible results obtained by general surgeons and practitioners in cesarean section.<sup>3</sup> What occurred in the vicinity of Boston in cities of 25,000 to 40,000 inhabitants undoubtedly occurred, and still does occur today in many other cities all over this country. Newell reported that in *Hospital A*, investigation proved that all the mothers died after cesarean section; in *Hospital B*, the mortality was 60 to 75 per cent; that in *Hospital C*, section was always fatal when performed by the local surgeon; and in *Hospital D*, the average mortality was 10 to 20 per cent, and in eclampsia it was 50 per cent."<sup>4</sup> Welz recently published the mortality from cesarean operations in the city of Detroit for 1926.<sup>4</sup> There were 154 sections with a 13 per cent maternal and 11 per cent fetal mortality. Compare these astounding facts with the results obtained by obstetric surgeons such as Hirst, Polak, DeLee, Williams, Peterson and others and there is no further need for argument as to who is best qualified to perform cesarean section.

In 1914 Opitz published a remarkable series of 443 low cervical sections for contracted pelvis with no deaths.<sup>5</sup> This was not a consecutive series, however, as deaths occurred in sections for eclampsia, heart disease, carcinoma, and other complications of pregnancy. This was at a period when Küstner reported 103 extraperitoneal operations with 2 per cent mortality, and Latzko, Bumm and Weibel published mortalities of 4.21 per cent, 2.85 per cent, and 3 per cent, respectively, with the transperitoneal operation.<sup>6</sup>

<sup>1</sup>DeLee's cure

*Indications.*—Dystocia due to disproportion at the inlet is the outstanding indication for section in our series. Dystocia becomes manifest when engagement of the presenting part fails after an adequate test of labor. In thirty-two of our cases, of which 75 per cent were primiparae, dystocia at the inlet was diagnosed after an average test of labor of 29.8 hours. (Table I.) This complication occurred in some patients with normal pelvis and normal sized child where the presentation, position, or attitude was responsible for the maladaptation, as well as in patients with contracted pelvis, oversize child, or uterine malformation. In view of these findings it becomes obvious that accurate pelvimetry and cephalometry cannot always designate the clinical course of labor; deflexion and posterior position of the head frequently alter the expected course. What constitutes an adequate test of labor is a matter of dispute and must be decided after a careful study of each individual case. That no arbitrary number of hours can be considered a sufficient test for any given group of cases is well illustrated by the protracted discussion of this question by the members of the American Gynecological Society in consideration of Bailey's splendid paper<sup>7</sup> on this subject.

TABLE I. TEST OF LABOR 32 CASES

	HOURS
Shortest test	12
Longest	66
Average	29.8

Our remaining indications listed in Table II require no especial discussion. We may add, however, that the preliminary use of the hydrostatic bag serves as no contraindication to this type of cesarean section. The Voorhees bag was inserted in three of our patients from eight to thirty-three hours before section, in all of whom the mem-

TABLE II. INDICATIONS

	NO. CASES	PER CENT
Test of Labor	32	80.
Normal Pelvis	7	
Contracted Pelvis	13	
Mammoth Child	6	
Malformed Uterus	1	
Abnormal Presentation	3	
Postmaturity	2	
Habitual Fetal Death	3	7.5
Old Primiparity	4	10.0
Organic Heart Disease	2	5.0
Previous Cesarean	1	25.0
Eclampsia	1	
		5.0
Pre-Eclampsia	1	
Abruptio Placentae	1	2.5

In some of the cases more than one of the above indications were present.



TABLE III. STATE OF MEMBRANES

	CASES	PER CENT	HOURS
Intact	29	72.5	
Ruptured	11	27.5	
Shortest time			4
Longest time			72
Average time ruptured before operation			17.7

branes had previously ruptured, resulting in no serious increase in morbidity in the puerperium. (Table V.) Even in patients where the membranes were long ruptured and in whom intrapartem temperature rise was noted, the stay in the hospital was not prolonged. Five of such cases appear in our series, and in two of these the amniotic fluid

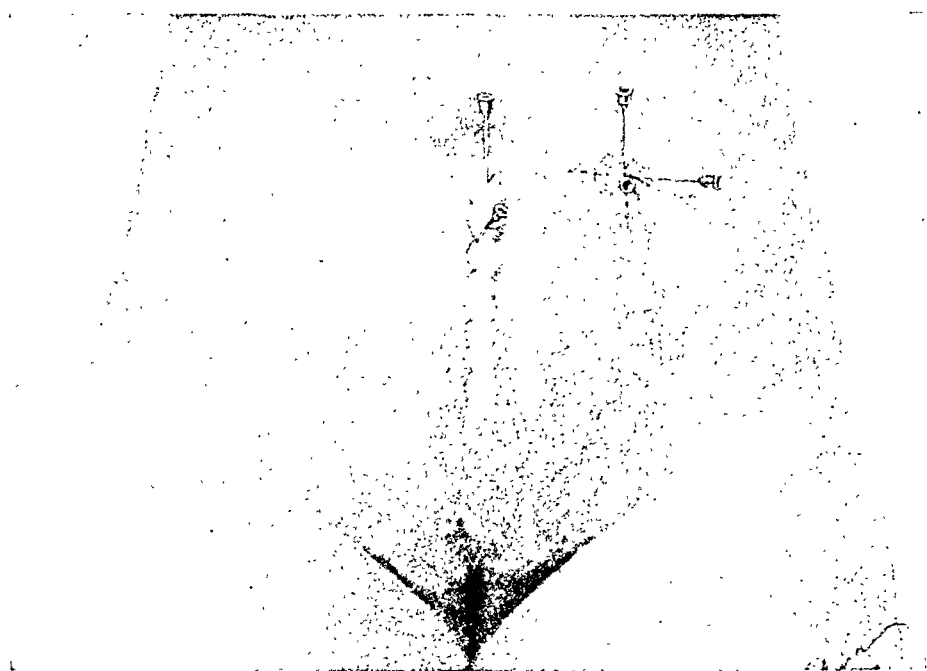


Fig. 1.—Infiltration of abdominal wall with local anesthesia. Median line is first infiltrated and then right and left lateral nerve blocks are simultaneously made. The entire procedure requires but five minutes.

was purulent, *B. coli* being obtained in cultures. The cord blood in these two cases also yielded *B. coli*, and the placentas upon microscopic examination showed evidence of marked placentitis.

*Technic.*—The technic employed was essentially that described by DeLee except that in the last thirteen cases the transverse uterine incision was used, as was recently described by Munro Kerr<sup>11</sup> and first suggested by Kehrer in 1881.

Preoperatively the external genitalia and abdomen are shaved and thoroughly cleansed with green soap and water. The entire perineum is then coated with 1 per cent mercurochrome solution, and catheterization is done with a No. 16 soft rubber male catheter. Two drachms of the 1 per cent mercurochrome solution is instilled into the bladder before the catheter is removed. One ounce of the mercurochrome

solution is then instilled into the vagina by means of a glass irrigating syringe, and the perineum is covered with sterile towels. The abdomen is further prepared with 60 per cent alcohol, ether, and a coating of half strength tincture of iodine. The patient is placed in a moderate Trendelenberg position, and the abdominal wall is infiltrated with  $\frac{1}{2}$  per cent novocaine solution with two minims 1:1,000 adrenalin solution to the ounce. As much as 5 to 6 ounces of this solution may be safely used. Beginning just below the umbilicus, the midline is first infiltrated intracutaneously by a continuous series of blebs, and then through these the fused sheaths of the recti muscles are infiltrated. In lines closely paralleling the external borders of both underlying recti muscles, two more series of intracutaneous blebs are made, five on each side, and deep injections through these as far as the approximate depth of the transversalis muscles, for it is at this level that the nerves branch off which supply the abdominal wall. The plane of this infiltration reaches from just above the level of the umbilicus to the crest of the pube, and blocks the tenth,

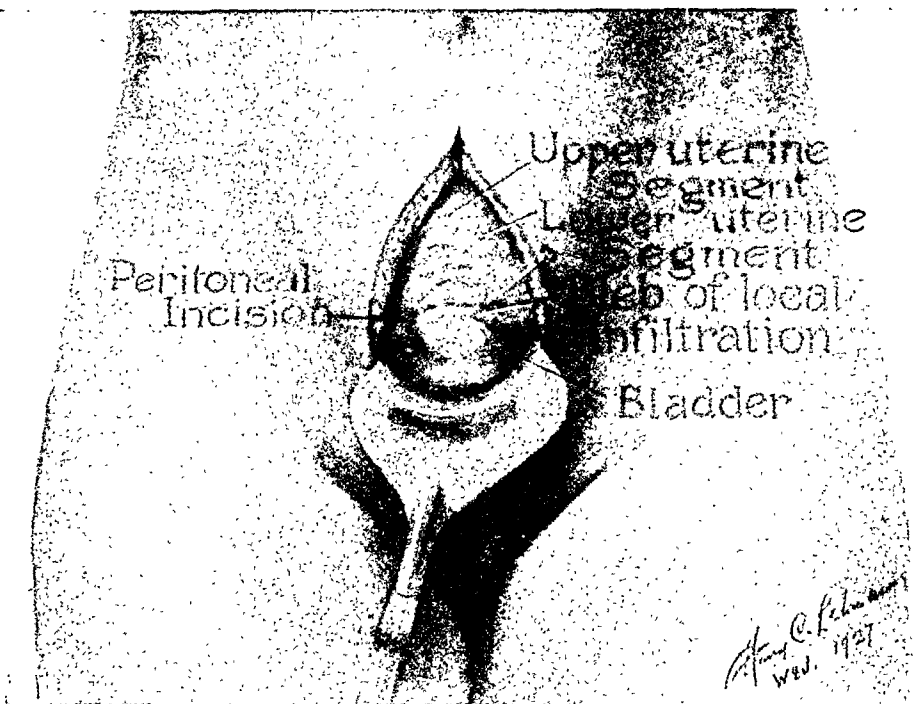


Fig. 2.—Lower uterine segment exposed with the use of a single retractor. Local infiltration of visceral peritoneum is indicated, as is also the site of the peritoneal incision. The abdominal incision is just large enough to permit the delivery of the fetus. No laparotomy pads are inserted.

eleventh, and twelfth intercostals, the ilio-hypogastric, and the ilio-inguinal nerves. Experience has taught us that the region just above the symphysis pubis is always most sensitive and requires more anesthesia. This is readily accounted for by the rich cutaneous nerve supply, this small region being supplied by cutaneous branches of the twelfth intercostal (subcostal), ilio-hypogastric and ilio-inguinal nerves. The infiltration requires about five minutes for completion, and at the end of this period it is possible to incise the skin and subcutaneous tissue painlessly. While the superficial bleeders are being ligated and laparotomy sponges are applied to the skin, the nerve block has more time to become effective. The abdomen is opened by a median incision from the upper border of the symphysis pubis upwards for 10 to 12 cm. (4 to 5 inches), the subcutaneous fat being dissected back from the fascia so as to make the latter more accessible for closure. The fascia and peritoneum are then incised, and the sides and inferior corner of the parietal peritoneum are anchored to the

subcutaneous fat by three temporary catgut sutures. If upon incising the fascia or peritoneum any area is painful, additional local infiltration is made. The bladder is then held under the symphysis, using one of DeLee's "corner retractors," thus exposing the lower uterine segment. About 5 to 8 c.c. of the local anesthetic is then injected under the visceral peritoneum covering the lower uterine segment (Fig. 2) and is diffused with the finger. The peritoneum now stands out from the uterine muscle, and is incised transversely midway between the bladder reflection and the retraction ring, and is loosened by blunt dissection upwards and downwards. The corner retractor is then slipped under the lower peritoneal flap, holding up the bladder and exposing the denuded lower uterine segment. A longitudinal incision about 3 to 4 inches in length is made with a scalpel through the



FIG. 3.—Transverse incision in lower uterine segment. A single forceps blade is placed anterior to the fetal head which acts as an inclined plane for delivery of the head when pressure is made over the uterine fundus.

mucosure and as soon as the uterine cavity is opened, continuous suction of the liquor and blood is maintained by means of an aspirating apparatus. The fetal head is then delivered with forceps. The "hammock" forceps of DeLee is most useful in this operation. It is applied after the face is brought anterior by inserting a finger in the baby's mouth, and facilitates the delivery by direct upward traction. Immediately after delivery of the head, the edges of the uterine incision are grasped with several ring forceps and are lifted up, so as to prevent amniotic spill and also to expose the edges for closure. The placenta is usually allowed to separate spontaneously, but it is manually removed when the separation is delayed, and it is always delivered through the incision and is inspected before the closure of the uterine wound. After delivery of the child, the patient is given a hypodermic

of morphine sulphate gr. 1/6 and scopolamine gr. 1/150. In neurotic or apprehensive patients this medication may be given during the preoperative preparation of the patient. One ampoule of pituitrin is given intramuscularly just as the child is delivered, but ergot is only administered if bleeding is excessive. The uterine muscle is closed by two rows of No. 2 plain catgut continuous suture; the first suture closing the inner muscle layer being careful to coapt the ends of the incision accurately and also to avoid the decidua; the second row takes the remaining muscle and includes the fascial layer which overlies the lower uterine segment. Sometimes a third row of interrupted sutures is required. Rarely was the intestine or omentum visible in this series during the operation even though *no laparotomy pads were placed inside the peritoneal cavity*. The visceral peritoneum is closed by a seroserosus suture of No. 00 plain catgut making an almost invisible line of

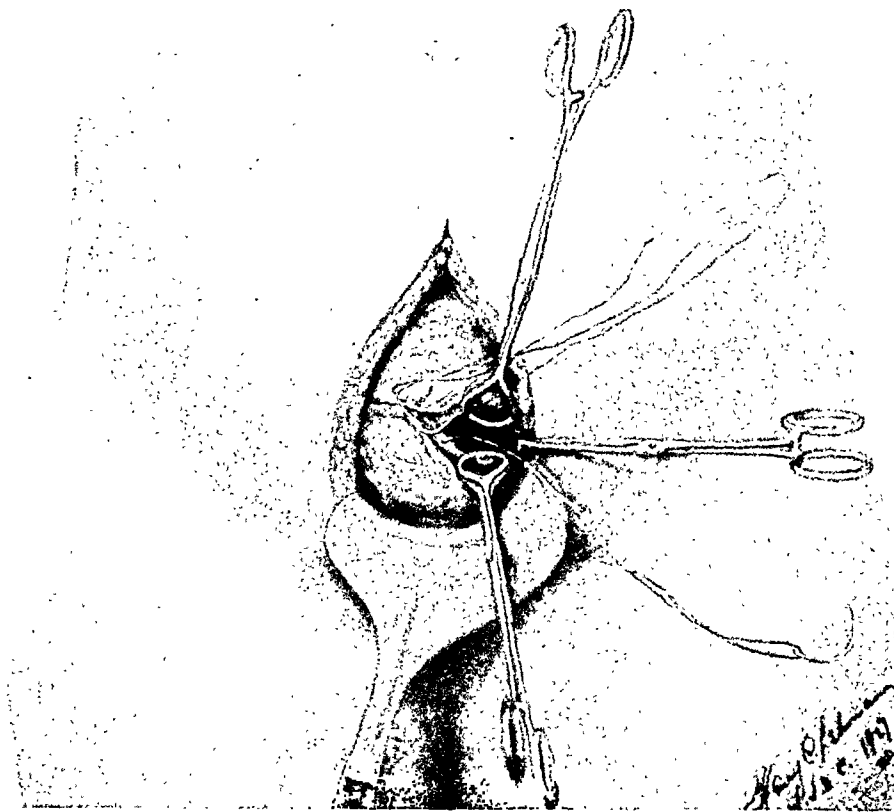


Fig. 4.—Suture of the transverse uterine incision. Note the satisfactory exposure of the entire wound with the use of only one corner retractor. The visceral peritoneum is united by a seroserosus fine continuous suture leaving an almost invisible closure.

closure. The parietal peritoneum is loosened from the temporary attachments and united by a seroserosus suture of plain catgut No. 1. The fascia is united with No. 2 plain catgut, a continuous stitch being employed interlocked every third, and for the skin a continuous black waxed-silk suture is used. A twisted silk-worm drain is placed subcutaneously in the lower angle of the incision.

The same technic is used with the transverse uterine incision (as shown in these illustrations) except that the incision in the lower uterine segment is transversely crescentic with the concavity upwards. This is begun centrally with a scalpel and completed to either side with the Mayo scissors, thus preserving the integrity of the amniotic sac and controlling the spill. This incision is planned to lie entirely in

the lower uterine segment, and should be adequate for delivery of the fetal head, so as to avoid cutting or tearing into the circular sinus at the junction of upper and lower uterine segments. This precaution has resulted in an almost bloodless field, whereas if the circular sinus is severed, profuse hemorrhage occurs. In none of our cases was hemorrhage a real menace. The head may be delivered through this incision with the aid of the hand, or more commonly with one blade of a Naegele forceps placed anteriorly just over the symphysis and used as a vectis (Fig. 3). With slight fundal pressure, the fetal head rolls along the forceps as an inclined plane, and is born. This incision was used in our last 13 cases, and has advantage over the longitudinal incision in that there is less bleeding, the head is delivered more readily, and the incision is more accessible for suture (Fig. 4). We have never observed extension of this incision by tearing into the broad ligament or upward into the vascular upper segment. Large fetal heads were readily delivered through relatively small transverse incisions. We modified the technic further by individualizing the use of uterine packing rather than making it a routine. In unquestionably clean cases with intact membranes and where hemorrhage was not a factor, no intrauterine gauze packing was used (16 cases). In the potentially infected cases (eight), three of which ran intrapartum temperatures, we employed sponges soaked in  $\frac{1}{3}$  strength Dakin's solution placed in and about the uterine and abdominal incisions as described by Bell,<sup>10</sup> and in addition, in two of these we soaked the retained gauze pack with the same solution. In cases where the uterine pack was used the metal shuttle described by DeLee proved very useful both in introducing the end of the gauze through the cervix without contaminating the uterine cavity, and also in locating the gauze in the vagina for removal. The packing was in some cases removed at the end of the operation, in some at the end of six hours, or in twelve to twenty-four hours where the cervix was but little dilated. The operation usually requires about one hour from the beginning of the induction of the anesthesia whether local or general, until the final dressing is applied. The shortest time in this series was forty-five minutes (local) and the longest 105 minutes (local and ethylene-oxygen) the average being 64 minutes for the 40 cases. The dressings are not disturbed until the fifth day, when the silkworm drain is removed and the wound is inspected. Tension and silk sutures are removed on the eighth day after which the wound is supported by a special adhesive laparotomy corset, and the patient is allowed out of bed.

*Anesthesia.*—In 70 per cent of our patients local anesthesia was employed. (Table IV.) In seven of these, it was necessary to administer ethylene-oxygen analgesia in addition to the local, chiefly to satisfy the patient's request for gas. In these cases 25 per cent ethylene with oxygen was administered while the uterine and abdominal wounds were being sutured. Many of the patients admitted afterward that they really suffered no pain but that the idea of local anesthesia made

TABLE IV. ANESTHESIA

TYPE	NUMBER CASES	PER CENT
Ether	6	15.0
Ether, N <sub>2</sub> O-O	3	7.5
Ether, Ethylene, O <sub>2</sub>	1	2.5
Ethylene, O <sub>2</sub>	2	5.0
Local (Alone)	21	52.5
Local, Ethylene, O <sub>2</sub>	7	17.5
Total Local	28	70.0
Total	40	

them nervous and uncomfortable. In the early part of the series general anesthesia was used until we felt that our technic was smooth. We now feel very strongly that local anesthesia is preferable. We fully agree with DeLee that it requires greater gentleness in technic, thus favoring primary wound healing. We do not agree with the latter authority, however, in his criticism of the use of ethylene. He claims that ethylene changes the constitution of the blood so as to produce free hemorrhage. This statement, we believe, fails of proof. In fact that Straus and Rubin have shown<sup>8</sup> in their observations upon 25 patients that the *coagulation and bleeding times were decreased* both during and immediately after complete surgical ethylene-oxygen anesthesia. It does, according to Stander,<sup>9</sup> increase the *toxicity* of the blood, and therefore stands in the same class with other general anesthetics in relation to the toxemias of pregnancy.

Local anesthesia is just as applicable where time is a factor as is general anesthesia. In fact we observed that the operations which required the shortest time for performance were those done under local anesthesia upon patients who were calm and cooperative. We found that there was less straining and, consequently, less delay when the patient was awake and was willing to help. We rarely needed to use a sponge inside the peritoneal cavity or in the uterus in the patients under local anesthesia, the suction apparatus satisfactorily removing blood and liquor, but when retching or vomiting occurred during the induction of a general anesthetic, laparotomy pads were often required, as well as considerable sponging. The minimum trauma to the tissues obviously makes for greater comfort to the patient during convalescence and conduces to more perfect wound healing.

*Convalescence.*—Convalescence from low cervical cesarean is most satisfactory. Freedom from the usual surgical postoperative discomforts is strikingly noticeable to all who share in the aftercare of these patients. Shock, sepsis, hemorrhage, and peritonitis, the cardinal dangers of classical section, are conspicuous by their absence from the morbidity list. Patients are usually well enough to eat a light meal a few hours after section under local anesthesia, and rarely have any complaints throughout the convalescence.

The complications encountered in our patients were more or less of a minor nature (Table V). The sapremia, pyelitis, and ileus here

TABLE V. MORBIDITY, COMPARING LOCAL AND GENERAL ANESTHETIC

COMPLICATION	TOTAL, 40 CASES	LOCAL, 21 CASES	GENERAL, 19 CASES
1. Nausea	17 or 42.5%	3 or 14.3%	14 or 73.6%
2. Ileus	4 or 10 %	2 or 9.5%	2 or 10.5%
3. Abdominal Wound Infection	2 or 5 %	2 or 9.4%	0 or 0 %
4. Pulmonary Complications	2 or 5 %	1 or 4.5%	1 or 5.2%
5. Pyelitis (Mild)	3 or 7.5%	0 or 0 %	3 or 26 %
6. Sapremia (Mild in all cases)	7 or 17.5%	6 or 28.5%	1 or 5.6%
7. Breast Infection	2 or 5 %	2 or 9.4%	0 or 0 %

listed were not severe. There were no bladder injuries, and only the usual number of catheterizations required after pelvic delivery were needed.

It was observed in a number of uncomplicated afebrile patients that in the early puerperium the lochia were notably scant. This fact disturbed us somewhat at first, but later gave us no concern as involution proceeded normally in these cases.

Patients are usually permitted the back rest on the third day and allowed to sit in a chair on the ninth day, the skin sutures having been removed on the day previous. The patient is discharged from the hospital as a rule on the twelfth to fourteenth day. (Table VI.)

TABLE VI. CONVALESCENCE, 40 CASES

	AVERAGE DAY OUT OF BED	AVERAGE DAY DISCHARGED FROM HOSPITAL
19 Cases General Anesthetic	13.8	16.3
21 Cases Local Anesthetic	11.5	13.2
Total Average	12.2	14.9

## CONCLUSIONS

1. Low cervical cesarean section so popular in European clinics is gaining favor in America because of the striking results as compared with those of classic section.

2. This type of operation because of its safety permits of far broader indications than does the classic cesarean, and should be chosen in preference to high forceps, pubiotomy, or craniotomy when dystocia from disproportion at the inlet is manifest.

3. Rupture of the membranes, previous bag induction, and antepartum or intrapartum infection do not contraindicate this type of abdominal delivery.

4. An adequate test of labor is more significant in establishing the indication for laparotrachelotomy than are accurate pelvic measurements.

5. The operation under local anesthesia as described above is highly recommended because of the low morbidity, rapid and smooth convalescence, and applicability to the widest range of indications for cesarean section.

6. The operation while not difficult is purely an obstetric procedure and should be performed by the surgically trained obstetrician.

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(For discussion, see page 295.)

## FIVE YEARS' EXPERIENCE WITH LOW CERVICAL CESAREAN SECTION\*

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IN 1922 we began in the gynecologic-obstetric service of the Evanston Hospital to make use of the low cervical cesarean section. We were moved to try the operation because of the favorable reports by DeLee and Beck in this country and by the results from many German clinics appearing in the literature, as well as those from French and English sources. Our experience with cesarean section prior to that time had caused us to conclude that, while the classic operation was very satisfactory in the elective case or for the woman who was still in the early hours of labor, convalescence in cases operated upon after labor had been in progress any length of time was so stormy that one hesitated to use the operation after a test of labor. Reports from many sources agree that the danger of classic section increases with the length of labor. This interferes with its usefulness as a procedure which may be used after a test of labor. The unjustifiably high death rate from cesarean section in this country is due, at least in part, to the use of the operation after many hours of labor. Sections done after attempts at vaginal delivery have been made, with consequent infection of the genital tract, have caused many deaths, with a consequent increase in the percentage of mortality. This was very clearly shown by the report of Eardley Holland who carefully studied the results of about 4000 sections in the British Isles. It is generally agreed that classic section is essentially an elective operation, or one for the early hours of labor, and that its use after many hours of labor is open to question.

If one accepts this conclusion, and it has been our position for many years, then one must either operate before labor, or, should engagement fail to occur after an adequate test of labor, one must terminate the labor from below by whatever means may be possible. This means an inevitable increase in infant mortality. It means also that the mothers are subjected to forms of interference which carry a

\*Read at a meeting of the Chicago Gynecological Society, December 16, 1927.



mortality at least equal to that which our experience has shown us may be expected from the low cervical operation, as well as to injuries which are sometimes extensive, and the repair of which, owing to the poor condition of the mother, is often unsatisfactory. If one adopts one alternative, unnecessary sections are done in the fear of dystocia. If the other is chosen, a certain percentage of difficult deliveries is inevitable with the consequent fetal loss of life and maternal injury.

In the border-line class of pelvic contraction, experience shows that 80 per cent of women will deliver either spontaneously or with a simple and easy forceps to help them after tedious labors. It is particularly in this class of cases, in which one wishes to try a test of labor, that a safe method of abdominal delivery for the minority in whom the test of labor fails, is of value. Our first operations were done under these circumstances.

Our first cases impressed us by their easy, smooth convalescences. These women who had been operated upon after many hours of labor had far less distention and vomiting than we had been accustomed to see in our elective classic sections. While at first elective operations continued to be done by the classic method, this difference in the character of the recovery from the two operations caused us to use the older operation less and less. At present the classic operation is infrequently done, and usually in cases in which for some reason the low operation would not be entirely simple.

We have now done the operation 50 times. Of these, 30 were done after a test of labor. It may properly be asked what we consider to be a test of labor. It does not seem to us that a rule may be given which will, without exception, fit all cases. A certain amount of judgment must be used in applying all surgical procedures. But of the rules which have been given, perhaps the best is that one may consider a test of labor to have been had if the cervix is dilated, the membranes ruptured, and good pains have continued, after both the above conditions have been accomplished, at intervals of not over five minutes, for at least one hour. No rule may be adhered to without exception. But a conscientious obstetrician will at least satisfy himself that delivery is not likely to occur and will not operate after a few pains.

The convalescences of these women were far smoother than those of any similar number of classic cases which we have had.

The more favorable postoperative course is due to two factors. First, the incision in the inactive lower uterine segment, which does not contract actively as does the uterine body. Second, the covering over of the incision in the uterus by the vesical flap of peritoneum and by the bladder itself, which still further prevents the migration of infective material from the interior of the uterus to the peritoneal

cavity. These factors have been discussed by so many writers that we shall not enter into them. We believe the spill of the amniotic fluid is a factor of little importance in the production of postoperative morbidity. The important cause of distention in the classic operation is the migration of bacteria or bacteria laden material through the incision into the abdomen. All women have bacteria in the lower uterine segment within thirty-six hours after delivery. If abdominal

Fig. 1.

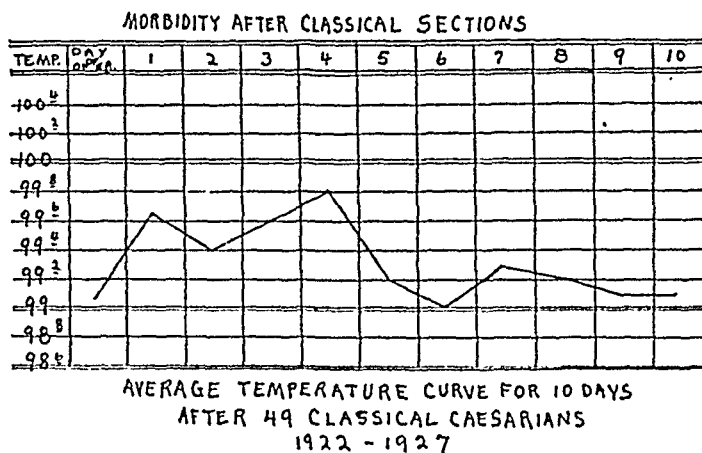
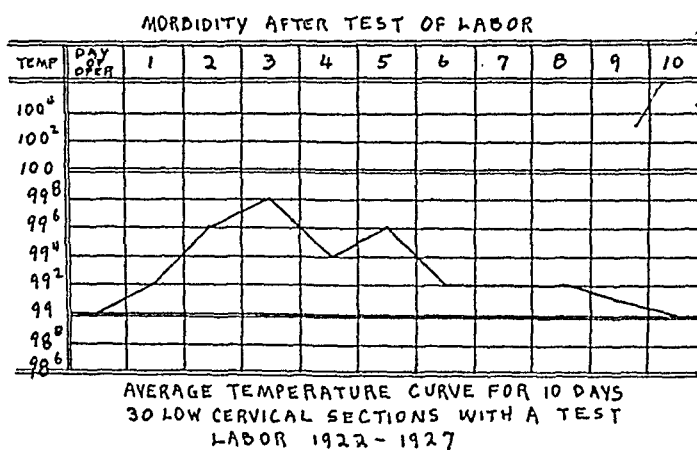


Fig. 2.



delivery is done many hours after the beginning of labor, particularly if the bag of waters is ruptured, bacteria may be there already. The strong contractions of the empty uterus, the "after-pains," grinding the edges of the recently sutured wound upon each other, cause serum or blood containing bacteria to be forced through the wound into the peritoneum. The postoperative distention is due to a low grade peritonitis which usually clears up after a few days. In cases operated upon after long labors or after operative attempts from below, the infection is a more serious one.

The invasion of the peritoneum by bacteria from the uterine cavity is avoided by the low cervical operation. It is this factor which gives this operation its greater freedom from postoperative discomfort and its greater degree of safety.

The technic which we have used is essentially that which has been described by others. After entering the abdomen the general abdominal cavity is protected by a long pad placed under the edges of the incision in a horseshoe shape, with the opening below. The vesical peritoneum is opened just below its upper border, going far enough below this point to allow for an upper flap. The bladder is stripped downward with the fingers, and held under the symphysis with a retractor. A short incision with a scalpel is made at the upper part of the lower uterine segment. This is lengthened downward with scissors. A pair of simple straight Mayo scissors is convenient for this purpose. We have not found any advantage in knives, especially devised for this step of the operation. After the incision in the lower uterine segment is made, we have found it of advantage to use an electrically driven aspirator to keep the wound clear. The face of the child is rotated to the front by the hand, a finger being placed in the mouth to facilitate this. The head is then slowly delivered with forceps which are put on with the concavity toward the symphysis.

The special forceps of DeLee devised for use in this operation, or any short forceps, may be used. The placenta is removed manually.

Should there be some freely bleeding vessels in the edge of the incision they may be caught at this time with "T" forceps which are very useful for controlling bleeding at this stage. In some cases considerable bleeding is encountered. It is nearly always controlled without great difficulty.

The incision is closed by two rows of running sutures, using number 2 chromic gut. We have found that this closes the wall of the lower uterine segment well and controls bleeding.

For a considerable time we imbricated the peritoneum in all cases. At present we imbricate only in those in which we feel that additional protection against infection is needed. In most of our cases we merely unite the peritoneal edges.

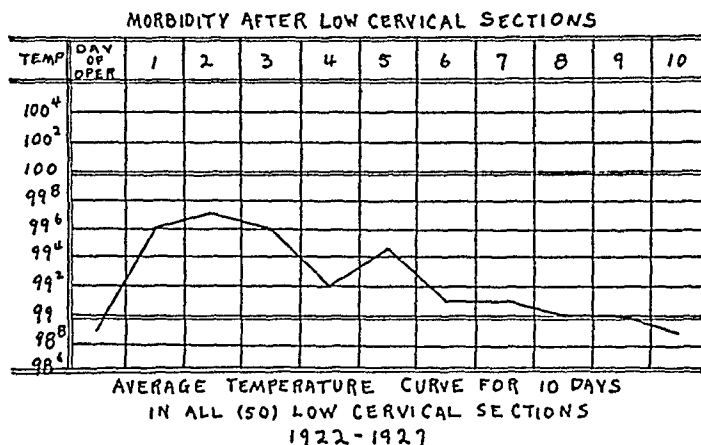
We have always in readiness instruments and gauze for packing the uterus, but up to the present time it has not been necessary to pack the uterus in any case.

It has been objected by some of those who have not favored the newer procedure that in a woman who is not in labor, or who had not been in labor long enough for the cervix to be entirely unfolded, the upper end of the incision might extend into the uterine body. It is true that in such cases the incision may extend above the upper limit of the lower uterine segment. It has been said by critics of the operation that this takes away all the theoretical advantage of the operation. It is not desired that extension into the uterine body shall occur, and its occurrence may, as a rule, be limited to the cases in which the cervix is slightly or wholly unfolded, and in these the invasion of the uterine body is rarely more than two centimeters. Whenever this occurs, attention is given to careful closure and the upper end of the wound is covered by imbricated peritoneum. Our experience has been that recovery in these cases is as smooth as in other cases. Our interest is much more concerned in the comfort and safety which experience shows our patients have than in merely theoretical considerations.

We have in 2 cases inadvertently passed the cervical rim and extended the incision downward into the upper part of the anterior wall of the vagina. The vaginal wall was opened for two centimeters in one case and scarcely more than a centimeter in the other. Contact with the vaginal cavity by hands or instruments was carefully avoided except for necessary sutures in the anterior wall. The recovery was uneventful in both cases.

Our total number of low cervical sections is 50. Of these, 30 were operated upon after a test of labor. The length of labor has averaged 21.7 hours. Of the cases undergoing test of labor, 10 ruptured the bag of waters early in labor. In these 10 cases the average length of time between the rupture of the bag and delivery was 12.5 hours. The average range of temperature in this series is indicated by the curve shown in Fig. 2.

Fig. 3.



#### 30 Cases Having Test of Labor

Average hours in labor	-----	21.7 hours
Number with ruptured membranes	-----	10.0
Average number hours ruptured	-----	12.5 hours

If we take the entire number of women delivered in the hospital from the beginning of 1922 until November 1, 1927, the time at which this report is written, the incidence of cesarean section is 1 in 41.2. This is a larger incidence than we would have if we were dealing with a series of cases the greater number of which were in a charity ward. Our private work consists each year of a considerable number of women who come because of trouble in a previous labor or who are sent by their physicians who fear abnormal labors. At one time during the past year the senior author had under observation at one time 5 women who had had disastrous experiences in former labors. All of these had lost their babies. Three of them had pelves below the normal in their measurements. Another had dense, extensive radiating

vaginal scars extending high up and diminishing the size of the vaginal vault. These 4 were delivered by section; the fifth woman was delivered by the natural route. It is possible that some of these, with a long test of labor, might have delivered vaginally. We are extremely careful in the case of a woman who has already lost a baby, to give her every possible chance of a living and uninjured child. Section is not adopted routinely in these cases, as a considerable part of them do not need it. As our service contains a large proportion of private cases, we find it necessary to be very careful of our fetal death rate. High forceps deliveries are extremely rare. During the past two years only one was done. This was by a member of the courtesy staff of the hospital. During the past four years no member of our own service has done it. A few patients are delivered by version.

TABLE I

HOSPITAL	YEARS	INCIDENCE	PER CENT	TOTAL CASES
N. Y. Lying-In	1922-3-4-5-6	1 in 33 plus	3.005	31375
Boston Lying-In	1924-5-6	1 in 28 (Including abdominal therapeutic abortions)		
Sloan, N. Y.	1922-3-4-5-6	1 in 22.5	3.57	8540
Chicago Lying-In	1925-6	1 in 34.4	4.50	8208
Evanston Hospital	1923-4-5-6-7	1 in 41.0	2.08	8006
			1.64	3585

There has been no maternal mortality and only one infant death. This occurred in the case of a woman with a pelvis much below normal in its measurements who had been in labor forty-four hours before operation. She was brought to the hospital at the expiration of this time. No vaginal examination had been made by her attendant, and she showed no evidence of infection. The fetal heart was audible but very rapid. To give the child a chance for life the abdominal route was chosen. The child was delivered alive but lived only an hour. The woman made a good recovery.

There had been no case in which the convalescence was sufficiently disturbed to cause serious anxiety. In one case during the past year a hematoma developed between the anterior surface of the lower uterine segment and the bladder. This absorbed spontaneously.

We feel that the low cervical operation is a valuable addition to obstetric technic. The fact that it can be used after a labor of considerable length is of itself sufficient to recommend it. It is true that it is a little more complicated than the older operation, but there is nothing about it which would trouble any surgeon who is accustomed to abdominal work. It should be used in preference to the classic operation in all women who are in labor. This should especially be so if the labor has lasted any length of time.

Our results have shown that it may with safety be used after an adequate test of labor.

The difference in the average convalescence between the low operation and the classic one, the difference all being in favor of the newer operation, causes us to believe that it is a better operation for routine use than the classic section. This opinion is based upon the first hand observation of an ample number of both methods, and it is upon such experience alone that definite statements may be made.

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(For discussion, see page 295.)

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THE EFFECT OF BILE SALTS UPON THE AUTOMATIC CONTRACTIONS OF THE UTERUS AND UPON THE ACTION OF PITUITARY EXTRACT DURING PREGNANCY: A POSSIBLE EXPLANATION FOR THE CAUSE OF LABOR

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FOR centuries the medical profession has constantly endeavored in various ways to unravel the mystery of the causation of labor, and a vast literature has accumulated upon the subject. Without detracting from the brilliance of some of the conceptions which have been advanced, the general impression prevails that most of the theories bearing on the problem are unsatisfactory and that none of them are of universal application.

In this study, I wish to direct attention to two recent papers which are worthy of comment because of their bearing on clinical facts. Dixon and Marshall pointed out that the concentration of the oxytocic substances present in the dogs' cerebrospinal fluid may be increased by the intravenous injection of ovarian extracts prepared from ovaries removed just before parturition while injections of similarly prepared extracts of corpus luteum or of other tissues failed to induce secretion of the posterior lobe of the pituitary gland. Their experiments led them to conclude that the corpus luteum exerts a dominating effect upon the ovarian function and that pituitary secretion is held in abeyance by the presence of corpus luteum. Consequently, the latter organ must play a prominent part in maintaining pregnancy. They consider that a definite but hitherto unexplained change in the ovarian secretion, associated with sudden degenerative processes within the corpus luteum at term, is the factor responsible for inducing pituitary secretion, which, in turn, renders the uterus hypersensitive and highly responsive to other forms of stimulation. In other words, according to their trend of reasoning, labor begins as the result of an "ovarian-pituitary endocrine mechanism."

Ever since its enunciation, this attractive hypothesis has aroused a great deal of interest. Nevertheless, a number of valid objections have of late been advanced against it. First, it has been shown that the degeneration of the corpus luteum is a gradual process and does not occur suddenly. Moreover, much doubt has been cast upon the specificity of the alleged stimulation of the pituitary gland by ovarian extracts by the experiments of Blau and Hancher, who adduced evidence to show that extracts of the liver or the spleen may have a similar effect. The chief objection, however, lies in the clinical fact that oophorectomy, from the end of the second month of gestation to its termination, does not necessarily interfere with the normal progress of pregnancy, and as many such observations have been reported, it is now generally accepted that the corpus luteum may be safely removed after the very first part of pregnancy. On the other hand, the experience of recent years indicates that the significance of the corpus luteum during this period, although still debated, is still open for determination.

Knaus, in an attempt to approach the problem of the causation of labor from another angle, studied the functional alterations of the uterine muscle in rabbits during the various stages of pregnancy. He showed that in the first half irregularity of the spontaneous contractions both as to intensity and interval predominates while during the second half the waves assume a rhythmic and regular character. Moreover, with the advance of pregnancy, the automatic contractions occur in closer sequence and, in addition to a further increase in frequency and strength of the intermittent contractions, there can be seen a definite increase in the tone of the uterine muscle and the intrauterine pressure. Consequently, some slight additional stimulus, more particularly the administration of a comparatively small amount of pituitary extract during this period, may set labor in progress; whereas it would be without effect at an earlier period. In other words, according to Knaus's conception, the uterine muscle becomes gradually prepared for the process of parturition by a constant systematic training, and he considers that the striking changes in the functional activity of the uterus during pregnancy are due to an influence exerted by the pituitary gland. Knaus bases his claim for the predominant rôle of the hypophysis as the principal factor concerned in the production of the functional alterations of the uterine muscle during the second half of pregnancy upon the well-recognized sensitizing action of pituitary extract on the uterus. The immediate onset of labor thus constitutes the final step in the course of a series of typical developments which are governed and controlled by hypophyseal action.

In view of the essential complexity of the problem under discussion, the greatest present need seems to be the consideration of two of its fundamental aspects: the tolerance of the pregnant uterus toward the product of conception on one hand, and the immediate causation of

labor on the other. For the remarkable tolerance of the uterus to the presence of the embryo and to its increasing distention during pregnancy, no suitable explanation has as yet been advanced. Clinical experiments clearly show that we have been in error in accepting the belief that it is inseparably correlated with the activity of the corpus luteum. Moreover, the hypothesis advanced by Ancel and Bouin that "the myometrial gland" should be regarded as the responsible factor is based on mere speculation. Real advance in the scientific development of the subject can be achieved only by the actual demonstration in the blood of pregnant women of some chemical or hormonal principle, which is concerned with the inhibition of excessive uterine contraction.

In the search for such a principle, my interest was aroused by recent advances in our knowledge of the biologic effects of the bile salts. The pioneer work in this respect is credited to Asher, who showed that under the influence of even small amounts of bile salts, the action of certain drugs with characteristic effects upon the autonomic nervous system would become strikingly changed, and very often completely reversed. For example, the vagus-paralyzing or depressing action of atropin on the heart could thus be converted into a stimulation; while a reversal of the stimulating effect of acetyl-cholin has likewise been demonstrated. An acceptable basis for the interpretation of such phenomena is afforded by the recognized ability of the bile salts to lower the surface tension (Asher, Rosenthal, Adler, Neubauer). Another interesting feature of the biologic effects of bile salts is their property of greatly diminishing the excitability of the parasympathetic system. The elaboration of sodium glycocholate and taurocholate is at present recognized as an intermediary stage in cholesterol metabolism, and these salts are designated by Asher as "true liver hormones."

As far as the biology of human pregnancy is concerned, reference is necessary to the recent work of Süssstrunk, and also of Kleesattel, who independently adduced evidence to show that beginning with the end of the second month of pregnancy there occurs a gradual but steady increase in the bile-acid content of the blood, which finally reaches a level three times higher than in the nonpregnant woman. The method employed for the determination of bile acids was originated by Wieland, and later somewhat modified by Frey. The occurrence of lowering of surface tension in the blood of pregnant women has been actually demonstrated by Lederer. In addition, an altered response of the pregnant uterus to adrenalin has been established by the experimental work of Dale, Cushny, Kehrer, and the stimulating effect of atropin on the small intestines in pregnant carnivora has been demonstrated by Hirz, Hofbauer, and others.

Taking all these considerations into account, we performed a series of experiments in the hope of obtaining some light on the interpreta-



uterine contractions in a guinea pig in the second half of pregnancy (2 weeks before term). It should be noted that the abolition of the contractions was associated with a distinct and continuous decline of the uterine tone. Eight drops of the diluted pituitary preparation produced an immediate sharp rise of the tone with subsequent regular rhythmic uterine contractions, occurring at intervals of five minutes. The addition of 8 more drops effected a further rise in tone and a closer sequence of uterine contractions, the intervals now being reduced to three minutes. A further increase in tone and frequency of contractions, with intervals reduced to one or two minutes followed the addition of 16 more drops diluted pituitary. Accordingly, it is seen that more sodium glycocholate was required to suppress the spontaneous contractions, while a smaller amount of pituitary extract sufficed to restore them than in the nonpregnant animal.

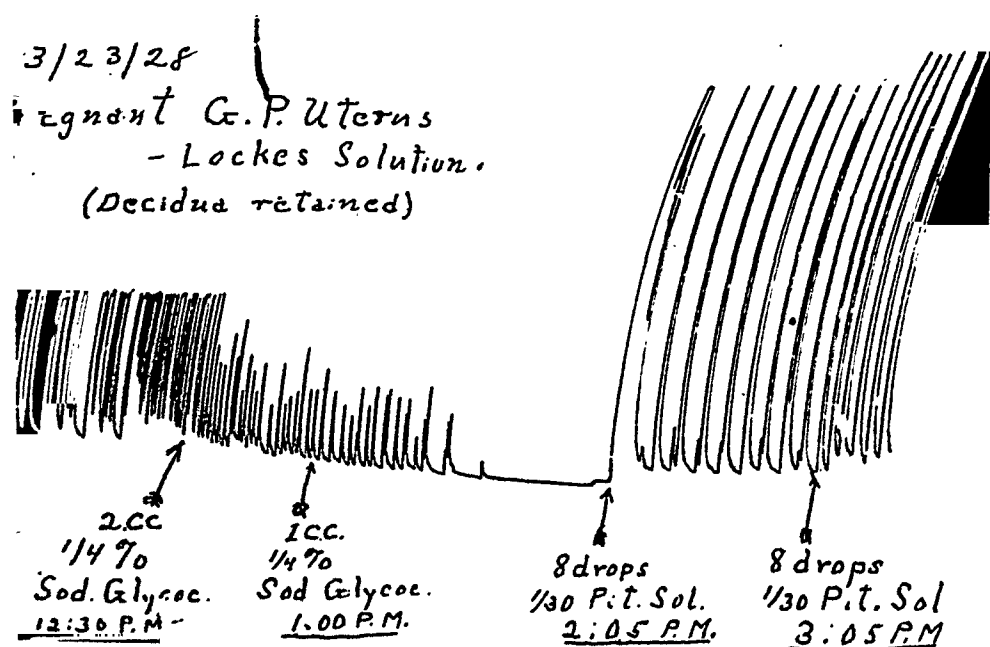


Fig. 3.

Tracing 3 (Fig. 3), obtained from a guinea pig's uterus near term, illustrates first that 3 c.c. of our sodium glycocholate solution were required to suppress completely the spontaneous uterine contractions, while a concomitant decrease in uterine tone is also noticeable. In the second place, it shows that 8 drops of diluted pituitary extract not only restored the contractions, but gave rise to a type much more violent than before, and of a higher tone. Furthermore, it is seen that the addition of a further eight drops led to an increase in tonicity, and reduced the intervals between the contractions from five to three minutes. In other words, this tracing seems to show that the effect of the sodium glycocholate is diminished while that of the pituitary extract is increased as pregnancy progresses toward term.

Several additional experiments conducted along similar lines convinced us that the saturation with bile salts likewise alters the response of the guinea pig's uterus to histamine, in that a  $\frac{1}{4}$  c.c. of 1:1000 solution failed to exhibit any visible influence, and the ordinary histamine effect did not occur until a dose twice as great as usual was added.

#### DISCUSSION

The reactions observed tend to show that the depressing effect of bile salts both upon the tone and the contraction of the uterine muscle may be an important factor in offering an adequate explanation for the remarkable tolerance of the pregnant uterus to the product of conception and its failure to expel it as it would any other foreign body. It would accordingly appear that the action of salts of the bile acids upon uterine activity is comparable to the effect of narcotics.

The fact that the bile acids are present in the blood during pregnancy in a considerably higher concentration than in the normal woman, is an apt illustration of the alteration of the liver function during gestation. The problem of the anatomic and functional changes of the liver during pregnancy has occupied the attention of the obstetricians ever since the author, in his monograph on the "Toxicoses of Pregnancy," emphasized the presence of venous passive congestion, depletion of glycogen associated with increase of fat substances in the central portion of the lobules, and stagnation of bile as characteristic features of the "liver in pregnancy." We shall not give here the entire list of competent investigators who in the intervening years have greatly extended this field of research. Suffice it to say that the recent studies of Schmidt have fully corroborated the microscopic characteristics mentioned above. The other phase of the subject, the instability of liver function or a lowering of its reserves, is supported by a wealth of evidence contained in the publication of Hofbauer, Linzenmeier, Nürnberger, Umber, Eufinger, and others, while our knowledge of hepatic physiology during normal and abnormal pregnancy is steadily increasing. The work of recent years with pituitrin and histamine indicates to what an extent liver function is under hormonal control.

Since recent clinical investigations indicate that an increased amount of bile acids may appear in the blood as a sequel of impaired liver function, new color is lent to the conception of the altered conditions of the liver in pregnant women on one hand, and to the cause of the rise of the titer of bile acids on the other. There is documentary evidence to show that an increased pituitary secretion produces both depletion of glycogen and fatty infiltration in the center of the liver lobules (R. Coope and E. H. Chamberlain). Moreover, a similar relationship obtains regarding the action of split products of proteins on the liver cells (Hofbauer). If we recall the fact that varying amounts of fetal

ectoderm are constantly cast off from the periphery of the chorionic villi and break down in the maternal blood, it is likewise conceivable that this factor may also be brought to bear on the aspect under discussion.

The interaction of bile salts and pituitary extract in our experiments involves a mechanism of considerable interest. The records obtained run parallel to clinical facts. The most characteristic feature consists in the failure of small amounts of pituitary extract to elicit contractions of the uterine muscle after its saturation with bile acids, whereas previous control doses had proved effective. The type of contractions observed in the virgin guinea pig's uterus following the repeated administration of increasing amounts of pituitary solution closely resembles that recorded in Knaus's investigations during the second half of pregnancy. The inhibitory effect of bile salts on the spontaneous uterine contractions is also manifested in the curves obtained from pregnant animals, although the nearer term is approached, the higher becomes the concentration of bile salts required to produce this depressing effect. On the other hand, a lesser amount of pituitary solution is required to overcome the inhibition, so that late in pregnancy a dose which previously had a minimal effect now has a powerful one, and gives rise to a type of contraction suggestive of that occurring at the time of labor.

On the basis of our observations it seems clear that the pregnant uterus responds more vigorously to the stimulating principle of pituitary extract and it is equally clear that the action of the latter is conditioned by the functional state of the uterine muscle. In other words, the presence of bile salts in the muscular tissue so alters its response to pituitary solution, that, instead of a tetanic state, as would be the ordinary response of the pregnant organ to this principle, rhythmic intermittent contractions ensue, which have no tendency to expel its contents. In these observations we have a further illustration of the fact, which has been repeatedly stated in recent years by pharmacologists, that the various hormones condition each other's action.

It is not only in consequence of the clinical experience with the induction of labor at term by the administration of pituitary extract that it has been suggested that this principle continues to operate during the onset and the further course of labor. Several investigators claim to have ascertained that an increased hypophyseal secretion of an oxytocic substance occurs during pregnancy, and more particularly during labor, as measured by its concentration in external liquor. Furthermore, in a few experiments conducted by us it appeared that the addition of 2 c.c. of serum obtained from parturient women to the 50 c.c. Locke's solution in which the guinea pig's uterus was suspended, produced a characteristic pituitrin effect. Finally, if one

considers the results recorded in our tracings, as well as the actual facts during labor, one can hardly escape the inference that such a controlling influence of the pituitary gland may be established.

In regard to the extent to which the data given above may be applied to the problem of the ultimate production of labor, it seems logical to assume that the activity of the pituitary may be in part responsible for it. At present, however, nothing of a positive character can be offered in explanation of its sudden onset, and additional data are essential before any final conclusion can be drawn. The work of Trendelenburg, however, which showed that electrical stimulation of the cervical sympathetic nerve increases pituitary secretion, linked with Cannon's statement that abdominal pain and also strong emotions or splanchnic stimulation tend to provoke adrenal action, may throw some light on the parallelism existing between the normal occurrences during labor and the effects of repeated doses of pituitary on the pregnant uterus, as established in this study.

#### CONCLUSIONS

With the fact established that there occurs a steady increase of bile salts in the blood of pregnant women, a study has been undertaken to determine their effect on the automatic contractions of the uteri of the virgin and pregnant guinea pigs.

The addition of bile salts suppresses the spontaneous uterine contractions, the effect being accomplished by the specific surface tension lowering power of the bile salts.

The relaxation of uterine tone could not be neutralized by the addition of small doses of pituitary extract which are otherwise effective.

Large amounts of pituitary extract produced strong uterine contractions, equal in character to the contractions occurring during labor.

*Note:* Our recent observations concerning the effect of highly diluted bile salts on the automatic contractions of the ureter show an increase in the intervals and a decrease in tone. The bearing of these facts on both the atony and the sluggish action of the ureter of the pregnant woman, and the counteracting effect of adrenalin are discussed in another paper (*Journal of Urology*, xx, No. 2). For further information concerning the conditions of the ureter during pregnancy, the reader is referred to Hofbauer's Monograph on Pyelitis in the March number of the *Johns Hopkins Hospital Bulletin*, 1928.

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## SOME POINTS IN VETERINARY PRACTICE OF INTEREST TO THE GYNECOLOGIST\*

BY G. L. MOENCH, M.D., NEW YORK, N. Y.

ON SEPTEMBER 12, 1927, I had the privilege of attending at Philadelphia the meeting of "The Society for the Study of Diseases of the Genital Organs of Domestic Animals." The program was excellent, thoroughly scientific, and represented almost throughout original work.

Perhaps my most outstanding impression, however, is of the excellent records and case histories possessed by the veterinarians. Our own records, even our best, would certainly not receive more than a Class "B" rating were the American College of Surgeons to apply veterinary standards. While it is of course true that veterinary records are more easily obtainable than ours, this alone still does not seem to me to be an entirely adequate explanation. I hope it will not sound too cynical if I express the belief that one of the reasons for the better records in veterinary medicine is to be found in the fact that in breeding animals the question of money plays such an important part, whereas the improvement of the human race, not being directly coupled with financial emoluments, is a less stimulating and exhilarating pastime.

Due to their fine case records and to the number of accurately controlled and controllable cases, veterinarians are able to demonstrate facts which are not only often disregarded, but at times even unknown in human medicine.

Dr. W. L. Williams, for instance, in his very fine paper on "The Significance of the Duration of Pregnancy in the Mare and Cow"—a paper which, by the way, I would recommend to every obstetrician and gynecologist for detailed study—brought out very many interesting points which I wish to touch upon briefly. Taking two of the best studied domestic uniparous animals, the cow and the horse, he finds the average duration of pregnancy in these two species to be around 285 and 334 days respectively with a tendency in the cow toward premature labor, and in the mare to go past term. Statistics for the cow show that the more services per achieved calf are required, that is, the lower the fertility or rate of conception the shorter on the average the duration of pregnancy will be and naturally the higher

\*Read at a meeting of the New York Obstetrical Society, February 14, 1928.

the rate of abortion. Conversely, the lower the rate of conception in the mare the longer generally the period of gestation. This may seem paradoxical but as Williams restates it: "The higher the rate of conception the more nearly the average duration of pregnancy will approach the ideal of 334 days for the mare and 285 days for the cow." That is, the average duration of pregnancy is a direct indicator of the fertility of the particular animals and, if the cows remain the same and healthy, the fertility of the bull is directly indicated by the length of the gestational period in the cows served by him. The most fertile bulls will have calves born around 285 days and the less fertile ones after 280 to 270 days or even less. In stallions, on the other hand, the lower fertility will be evidenced by the increased length of gestation in the mare over and above the ideal period of 334 days.

I have already pointed out in a previous paper read in this Society that habitual abortions and, of course, premature labors in some cases may perhaps be due to the male instead of the female. Veterinarians again, however, have gone much deeper into this subject than we. In human medicine we are apt to consider the prematurely born infant as particularly prone to ills of all kinds, but once the child has survived this early period the fact of its premature birth is considered insignificant and promptly forgotten. Here, however, is a very large field for improvement of our statistics and our knowledge of sterility. In breeding animals it has been shown that prematurely born calves are seldom good breeders later on, often even being sterile. May not then some of the human cases of primary sterility be explainable on the same basis? I have of late questioned sterile men and women as to whether or not they had been born prematurely, but found in most instances that the patients had no knowledge whatsoever of the subject.

Granted, however, that we consider premature birth as of some importance we certainly regard the overcarried child generally as particularly fortified to overcome life's vicissitudes. We think of him nearly always as a large overweight baby, who has only the increased possibility of dystocia to face. It is true DeLee<sup>1</sup> reports a child carried three weeks over term who weighed only three and a half pounds, but such a case is regarded as a great exception. In contradistinction to the generally accepted opinion regarding overcarried children, the animal breeder regards overcarried offspring with no more favor than he does premature animals and finds that they also often turn out to be sterile. Furthermore, although carried past term, they are frequently underweight. It would not only lead too far here to discuss all the possible theoretical explanations of these various findings, but would be aside from my purpose at this time, which is

solely to call attention to these commonly accepted and recognized opinions of the veterinarians and to bring out a discussion of the subject in this Society.

Before I leave the subject of sterility and fertility, however, I want to mention the interesting data presented by Conklin, of Quebec, regarding the fertility of the domestic cock. Conklin was especially concerned with the influence of the sexual health of the rooster on the fertility and hatchability of the eggs. He found that weakening the sexual health of the rooster by excessive sexual use or otherwise, resulted in a slight increase of the early death rate of the embryos in the eggs and in a tremendously increased late death rate. At the same time Conklin found, in principle at least, the same morphologic sperm changes which Williams and Savage have found in bulls and I have seen in the human male.

The last point I wish to touch upon before closing is the question of the bacterial content of the female genital tract above the external cervical os. In human medicine the bacteriologic sterility of the normal cervical canal, uterine cavity, and fallopian tubes has come to be accepted without question. It is true that Winter<sup>2</sup> found bacteria 11 times in 40 tubes from 31 patients, but since usually only one or two colonies grew in the cultures, this bacterial growth was considered the result of contamination. Winter, however, found bacteria of various types frequently around the region of the internal os in extirpated uteri and so considered the uterus sterile only above this region. At the same time he found that the pathogenic bacteria present, staphylococci and streptococci, etc., were of decreased virulence. Bumm<sup>3</sup> found bacteria in 15 cases of so-called endometritis (usually glandular hyperplasia of the endometrium) but considered the bacteria as concomitant to the disease and not its cause. Boige<sup>4</sup> found bacteria in some uteri but considered them the result of contamination. Other authors obtained similar results and gave similar interpretations. Gottschalk and Immermann,<sup>5</sup> however, found bacteria in 39 out of 60 cases of endometritis corporis and also found that bacteria after post-partum infections might remain a long time in the uterus in a quiescent state. Menge,<sup>6</sup> in contradistinction to most of the authors mentioned, found bacteria only six times in 73 corpus and 29 cervical examinations made on 75 uteri. Of these six cases three were carcinomas of the cervix associated with pyometra, one a cervical carcinoma, and one a degenerated fibromyoma. Menge decided that the genital tract a very short distance above the external os was sterile, a view which is the generally accepted one today.

Nevertheless we see that there is no uniform agreement regarding the bacteriologic content of the human female genital tract above the external cervical os, the generally accepted opinion of the sterility of this area being achieved only by calling any bacteria found here a con-

tamination. In veterinary medicine also there is no uniformity regarding this matter, but the general trend today is to consider bacteria as usually present in the cervix and uterus but in a less virulent form so that symptoms are caused only when some added factor enables the bacteria to grow. The fact that a bacterial content of the normal uterus is so contrary to human medicine is answered by the veterinarian, and perhaps justly so, by pointing out that the facilities for doing such research work in animals are so immeasurably greater than in human medicine that their results are more liable to be correct than ours. Beller,<sup>7</sup> for instance, in extremely careful bacteriologic studies, has shown bacteria not only in the uterus but inside of the intact fetal membranes, that is, in the allantois and amniotic fluids and even in the umbilical cord and placental vessels. Furthermore, the weight of evidence points to the fact that these bacteria do not come from the maternal blood stream but from the previously infected endometrium. Beller's findings corroborate the extensive work of Sohnle<sup>8</sup> and his collaborators, Hellendall<sup>9</sup> and Hofstadt,<sup>10</sup> and is in accordance with the work of Albrecht,<sup>11</sup> who out of 12 bovine uteri in advanced stages of gestation found only 3 free from bacteria. Beller comes to the conclusion that bacteria of various types are regularly present in the healthy pregnant and nonpregnant uteri but cause no recognizable injury because either their virulence is lowered or the resistance of the tissues is sufficiently high to prevent illness. Trouble occurs only when the vitality of the female becomes lowered in which event abortion may take place if the animal is pregnant. Veterinarians feel that the bacterial infection of the uterus and resulting from it, that of the placenta, causes such an enormous fetal mortality that it exceeds by far the death rate of the offspring for any extrauterine period of equal length. Thus between placental disease and the health and life of the pregnant female and of her intrauterine young there is an intimate interrelation. At certain epochs, like the period of gestation and estrum, there is a change in the efficacy of the reaction of the maternal organism to bacterial insult which needs to be overcome. If the necessary increased resistance fails to develop, the result is premature expulsion of the fetus; retained placenta, or even sterility. These statements are conclusions drawn from careful research work by competent observers in veterinary medicine and cannot be ignored by gynecologists. It seems to me that the whole field of the bacterial invasion of the uterus, both pregnant and nonpregnant, as well as during menstruation, is in need of a very careful revision and reexamination. The possibility of uterine infection causing abortion, as in the case of some of the domestic animals, must be especially carefully considered, for the more one studies the genital tract and its diseases in animals, the more evident the marked similarity to gynecology becomes.



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(For discussion, see page 292.)

## CAUSES AND PREVENTION OF STRICTURE AND OCCLUSION OF THE CERVIX UTERI\*

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THE literature on cervical stricture has not been brought to date. There is practically nothing approaching a thorough consideration of the subject in the writings of the last two decades. In the light of recent radical changes in our conception of the nature of cervical pathology and treatment, the older literature in many instances is no longer pertinent. We believe that the subject merits careful and thorough consideration in order to crystallize our present knowledge of the pathology following cervical inflammation and injury. On this structure we would like to establish a rationale for the therapy of cervical disease, in the interest of prevention of cervical stricture which is prone to follow certain forms of therapy. We wish, by tracing the pernicious effects of older methods of treatment, to emphasize the uniformity with which scar tissue occurs as the pathologic basis of the strictured and undilatable cervix; to minimize recourse to such diagnoses as "functional" or "spasmodic" contraction and to urge the adoption of revised methods of cervical therapy.

There has been no question in regard to the occurrence of complete occlusions of all or part of the cervical canal outside of pregnancy. The occurrence of complete occlusions during pregnancy, however, has been denied by well qualified observers (Velpau, Hantin, Baudeloque, Denman, Dewees). In the current edition of William's *Obstetrics* we find the statement that "Schroeder was probably right in stating that

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the so-called *conglutinatio orificii externi* is simply due to a very small and resistant opening." In a later paragraph, referring to cicatricial contractions, however, Williams says, "In two of my patients, cesarean section was necessary on account of complete atresia of the external os." After a study of the literature, there can be no question as to the occurrence of complete occlusion during the course of pregnancy, yet we caution against the diagnosis short of absolute certainty and submit the following case of one of us (Mathieu) to show that even after the most careful and painstaking search for a cervical canal, both from below and above (Porro section), one may be mistaken in supposing that there is a complete occlusion.

The patient, Mrs. B., was forty-three years old, a primipara, married eighteen years without pregnancy, and had taken no precautions against pregnancy for many years. The only factor of importance in the past history was a right ovariectomy five years previously. The menstrual history was entirely normal. There was considerable nausea during the first three months of pregnancy.

The abdominal findings were those of a normal six months' pregnancy. The pelvis was roomy and normal. The perineum was high and firm. From bimanual examination at six months, it was thought that there were small fibroids, a large cyst of the cervix, and no demonstrable cervical opening. Two weeks later, no opening could as yet be demonstrated, and the cyst of the cervix had enlarged considerably. A month later the cyst on the cervix had increased considerably in size, being as large as a lemon and extending over its posterior surface was a vein with a diameter of about 2 mm. Neither with the speculum and probe nor with the finger could the external os or any sign of a cervical opening be found. Because of the size of the fetus, the presence of the cervical cyst with the large vein on its posterior surface and the apparent stenosis of the cervix, together with the fact that the patient was a primipara forty-three years of age, a cesarean section at term was decided upon. August 19 (about seven weeks later) the cervix (per rectum) was as before. The McDonald measurement was 36 cm.

On September 29, two days before estimated term, an elective classic cesarean section was commenced, and completed as a Porro section because of placenta accreta which was later substantiated by pathologic examination. An effort was made to find an opening in the cervical canal but none was apparent. On the fourth day following operation there was slight serosanguineous drainage from the vagina. By the eleventh day vaginal drainage was well established and vaginal examination showed the cervical origin of the bloody discharge, definitely ruling out the existence of a complete occlusion. Mother and baby were discharged in good condition. Subsequent examination revealed the gradual shrinking and virtual disappearance of the cyst of the cervix.

We have reported the case here because, as far as we have been able to find in a study of the complete literature, it is one of four cases of apparent cervical occlusion where the fundus has been removed, leaving the cup-shaped lower uterine segment, in which, during a careful search, no trace of an opening into the cervical canal could be found. In another case recently done by DeLee (personal communication) no opening could be found during pregnancy because of post-operative scarring, but at the Porro section an opening the size of a

small lead pencil was found. We have found reported nineteen cesarean sections for cervical atresia, but in the fifteen cases where the fundus was not removed no opportunity as favorable as this was presented to verify the occlusion from above. We have no report to the effect that careful search has been made following classic or low cervical section, but the probabilities are that this has been done.

In the Porro section recently reported by Wilson of Brooklyn, there was a definite cervical occlusion. The author writes to us that there followed no sanguineous discharge which could be considered of cervical origin, and that at operation "no sign whatever of a canal was found, although not more than one-half inch of cervix was left; however, a probe was not inserted from above because of the need for haste due to the poor condition of the patient."

In answer to a question regarding another case, DeLee writes, "This was a woman, not syphilitic, who had had a previous puerperal septic process and as a result the whole vagina had scarred over, that is, what was left after the ulcerative process has been completed, and part of the vagina had sloughed away. She had also a rectovaginal fistula. There was hardly an opening to be found big enough to admit the point of a probe and at the time of operation, when I amputated the uterus, I could not find the opening that led into the vagina. I therefore made a low amputation of the uterus down to and almost into the scar in the vault of the vagina. There was no discharge after the operation, it healed by primary union."

In one case pregnancy is reported to have occurred during an amenorrhea apparently due to cervical occlusion. In this case, (Van deWarker) the patient was under observation "for many months by several physicians," with the signs and symptoms of complete occlusion. The enlargement of pregnancy was taken for hematometra until the fetal movements became unmistakable. There was complete occlusion at term. The method of delivery is not specified. If this case is accurately reported, we are constrained to believe that impregnation can occur through a cervical canal too small in caliber to permit the escape of menstrual products. We simply submit this material as of interest and do not commit ourselves. Simpson in 1831, performed a postmortem examination on a patient who died as a result of cervical atresia. Dr. Simpson says, "On dividing the uterus, from the fundus downward it was found that the growing together of the sides of the os uteri, leaving no vestige of a passage, was the result of mischief occurring in a former labor."

From these, and at least nine other observations, we are convinced of the occurrence of complete cervical occlusions during pregnancy, but admit that error in diagnosis is easy, even under conditions peculiarly favorable to careful examination.

Because of limited space, we are unable to include here a description of the increasing literature of the latter nineteenth century on this subject. We have appended a chronologic bibliography and graphs of the incidence of cases due to the various etiologic factors. A glance at this data (Fig. 1) will show that there began about 1860, with the work of DePaul and of Ozo, a considerable increase in interest in cervical stricture. Controversy is the great stimulant, and we find that with the development of two schools of cervical operations (trachelorhaphy versus amputation) and the use of caustics, cervical therapy

became a storm center. It is certain that disease, and injury to the cervix from childbirth, must always have operated to cause cervical stricture. But the introduction of new and radical procedures for the cure of cervical pathology in general certainly increased interest and quite definitely increased the actual incidence of cases. In the words of Pinard, "The results of the treatment were too often worse than the original disease." There arose the advocates and opponents of cervical operation, and the use of caustics and cautery gained its champions and accusers. Also, there was controversy between the champions of the two methods. The result was that the cervix came

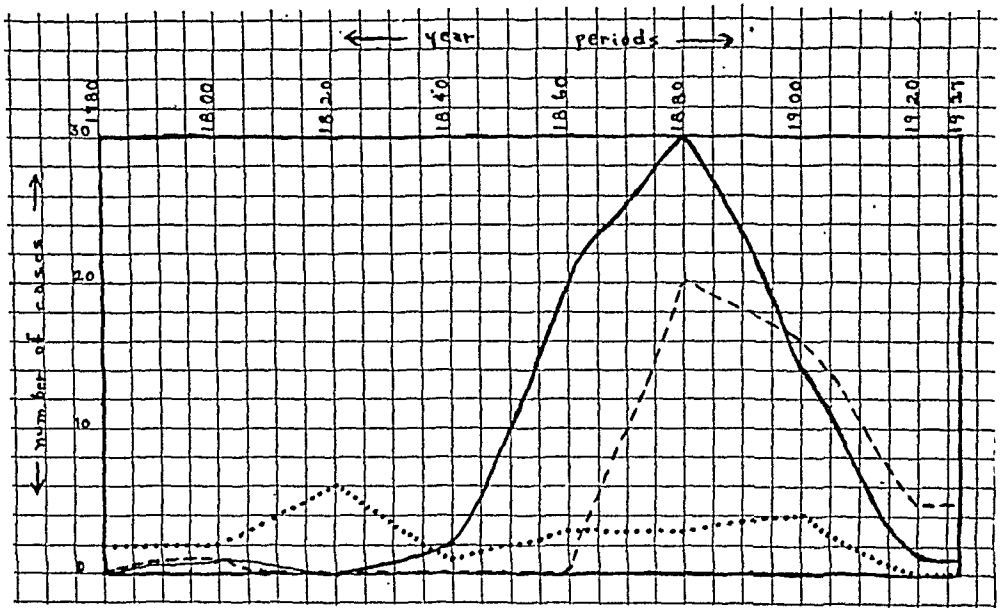


Fig. 1.—Incidence of cervical stricture following the use of caustics (—), operation (-----), and obstetrical trauma (.....).

These curves are compiled from all the available case reports of stricture of the cervix, but include only those in which the stricture was the obvious result of one of the foregoing procedures. Doubtful cases and those due to other factors have been eliminated. The striking feature is the rather constant curve for stricture resulting from obstetrical trauma as opposed to the sharp rise and fall of cases due to caustics and operation.

This increased incidence corresponding to the periods of maximum popularity of such methods is indicative of the important rôle of these methods of attempted therapy in the causation of serious cervical pathology. The subsequent fall in the number of cases due to caustics corresponds closely with the discontinuance of the use of this type of therapy, while the later and less radical drop in the number of cases following operation is effected by a less promiscuous use of cervical operations and by a clearer understanding of the contraindications.

in for its hey-day in the public eye, and has not before or since achieved such prominence in medical literature (1883-1904).

It is discouraging to have to admit that after a careful survey of all the available material, we feel sure that for a considerable period the majority of cases of true cervical stricture was due to methods meant to cure cervical disease. During this time, the congenital cases, and those due to obstetric injury or disease, decreased notably in their percentage of the total number of cases.

A better understanding of the anatomy and pathology of the cervix, together with the advent of the Sturmdorf tracheloplasty and the use

of linear cautery, has caused a complete revision of ideas in regard to treatment. Topical applications, tampons, and the like have no place. The use of caustics has been practically eliminated. The place of diathermy is not yet established. For the treatment of erosions, tears with ectropion, and the milder forms of endocervicitis, we have an efficient method in linear cautery (which we believe superior to radium). For the more serious distortions and infections which will not yield to cautery, there is the Sturmdorf tracheloplasty. Our confidence in the use of this armamentarium is so great that we would tend to assign failures to faulty technic.

#### CONCLUSIONS

The literature on stricture and stenosis of the cervix uteri needs revision. From observation of cases and a study of the literature, certain points of interest have been developed in the following order:

1. The existence of complete occlusion (or obliteration) of the cervical canal during pregnancy is clearly established. Such a process, however, could become complete only after impregnation had occurred. The clinical differentiation between complete occlusion and advanced stenosis may be difficult or practically impossible.

2. A study of the reported cases shows clearly that methods meant to correct cervical pathology (i.e., operation, caustics, cautery) are responsible for a notable increase in the total number of cases of true cervical stenosis, as well as for a definite relative increase in the number of cases following this type of therapy as compared to the number due to disease or obstetric injury.

3. A detailed consideration of the use of caustics and certain types of thermocautery gives authority to the modern conception that there is little or no place for this generally pernicious type of therapy in our modern armamentarium. However, from our own experience and the somewhat scant literature available, we feel that the accepted use of so-called "linear cautery" is well justified.

4. A painstaking analysis reveals that most authorities fear dystocia in pregnancies following both classic amputation and trachelorrhaphy, regardless of the skill used in operation. Stricture following their use is due to scarring from faulty coaptation of tissues, or to postoperative infection. With the advent of the linear cautery, the indications for operation on the cervix have been reduced to a minimum. Any operation which does not minimize the danger of infection by the removal of infected portions of endocervix is both inadequate and dangerous. There is favorable accord in regard to the use of the Sturmdorf tracheloplasty.

5. The obstetric significance of this and additional material will be considered in a subsequent paper under the heading of "The Rigid and Stenosed Cervix in the First Stage of Labor."

## SENSITIZATION OF GUINEA PIGS PER VAGINAM

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*Introductory.*—Sewall<sup>1</sup> in a paper published in *Science*, October 8, 1925, entitled "*The Rôle of Epithelium in Experimental Immunization*" called attention to certain extremely interesting and suggestive findings in connection with some studies on anaphylaxis and immunization. He found that the well-known phenomena of anaphylaxis and anaphylactic shock after an injection of a foreign protein which is followed by a second injection of the same protein after an interval of rest, can be produced by applying proteins to the mucous membranes of the nose. After a series of daily injections or insufflation of small quantities of horse serum into the nostrils of the guinea pig, he could produce anaphylactic shock if the animals were allowed a period of rest and then were given an injection of the same serum. These experiments demonstrate conclusively the absorption of foreign protein by the nasal mucous membranes and are of great interest in connection with study of hay fever and bronchial asthma in men.

In view of the above discoveries of Prof. Sewall it occurred to me that it might be of interest to inquire as to whether absorption of protein would occur in a similar way through the vaginal epithelium. This was especially desirable in view of the fact that foreign protein normally comes in contact with this mucous membrane after cohabitation.

*Method.*—Experiments were conducted on guinea pigs, which are the animals best adapted for such studies, and because normal horse serum offered a complex of antigens most convenient for use.

The procedure employed was as follows: Healthy female guinea pigs, both virgin and nonpregnant parous ones were selected and given daily injections or instillations of horse serum into the vagina. The instillations were conducted for periods varying from seven to fourteen days and the quantities of serum introduced ranged from 0.2 to 0.5 c.c. The instillations were made with an ordinary eye dropper without any injury to the mucous membranes. After the series of preparatory or preliminary injections or insufflations were carried out the animals were given a period of rest from nine to twelve days and then were ready for final study. The final test consisted in injecting the animals with horse serum varying in quantity from 0.5 to 1 c.c. and noting whether any anaphylactic shock or other signs of allergy were manifested. The injections were made in some animals subcutaneously, in others intraperitoneally, and in still others directly into the heart in which case the animal was first put under a light ether anesthesia.

*Results.*—The results obtained were very clear cut and striking. Table I gives a summary of the findings in case of ten such guinea pigs

TABLE I

NO. OF EXPERIMENT	PRELIMINARY TREATMENT	FINAL TEST	RESULT
Guinea Pig I	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected intraperitoneally after 9 days' rest 1 c.c. of horse serum.	Sneezing, rubbing of nose, bronchial breathing, relaxation of sphincter, twitching and dyspnea, partial paralysis in 15 minutes.
Guinea Pig II	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected intraperitoneally after 11 days' rest 1 c.c. of horse serum.	Sneezing, scratching of nose, twitching of muscles, bronchial breathing, flopping of ears, paresis of hind legs, convulsions and death in 20 minutes.
Guinea Pig III	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected intraperitoneally after 11 days' rest 1 c.c. of horse serum.	Sneezing, scratching of nose, twitching of muscles, bronchial breathing, flopping of ears, paresis of hind legs, convulsions and death in 25 minutes.
Guinea Pig IV	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected 0.75 c.c. of horse serum subcutaneously after rest of 11 days.	Twitching of abdomen and jaw muscles, blinking of eyes and flopping of ears, sneezing, rubbing of nose, bronchial breathing, slight depression, gradual subsidence of symptom after half hour.
Guinea Pig V	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected intraperitoneally after 11 days' rest 1 c.c. of horse serum.	Scratching and twitching of nose, twitching of ears, bronchial breathing, paresis.
Guinea Pig VI	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected slowly into heart under ether 1 c.c. horse serum after rest of 11 days.	Convulsions and death in three minutes.
Guinea Pig VII	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected after 11 days' rest in peritoneum 1 c.c. of horse serum.	Protrusion of eyes, scratching of nose, bronchial breathing, flopping of ears, depression, convulsions in 30 minutes, recovery.
Guinea Pig VIII	Vaginal instillation daily for 14 days of 0.5 c.c. of horse serum.	Injected intraperitoneally after rest of 10 days 1 c.c. of serum.	Convulsions and death in 5 minutes.

which were previously sensitized. Ten other protocols in the same table give the results in control experiments. It will be noted that when normal control guinea pigs were given an injection of even as much as 1 c.c. of horse serum either subcutaneously or into the heart, no effect whatever was produced and there were no signs of anaphylactic shock. Several controls were purposely made in order to produce the classic picture of anaphylactic shock. In these controls the animals were given injections by needle of serum, and subsequently after a period of rest received another dose of the antigen. It will be noted that the picture obtained in case of the animals sensitized

TABLE I—CONT'D

NO. OF EXPERIMENT	PRELIMINARY TREATMENT	FINAL TEST	RESULT
Guinea Pig IX	Vaginal instillation daily for 14 days of 0.5 c.c. of horse serum.	Injected subcutaneously 1 c.c. of horse serum after 10 days' rest.	Bronchial breathing, rubbing of nose, depression, paresis of hind legs.
Guinea Pig X	Vaginal instillation daily for 14 days of 0.5 c.c. of horse serum.	Injected subcutaneously 1 c.c. of horse serum after 10 days' rest.	Bronchial breathing, rubbing of nose, depression, paresis of hind legs.
Guinea Pig XI	Normal control, no previous sensitization.	Injected subcutaneously 1 c.c. of horse serum.	No effect.
Guinea Pig XII	Normal control, no previous sensitization.	Injected intraperitoneally 1 c.c. of horse serum.	No effect.
Guinea Pig XIII	Normal control, no previous sensitization.	Injected subcutaneously 2 c.c. of horse serum.	No effect.
Guinea Pig XIV	Normal control, no previous sensitization.	Injected intraperitoneally 1.5 c.c. of horse serum.	No effect.
Guinea Pig XV	Normal control, no previous sensitization.	Injected in heart 0.5 c.c. of horse serum.	Slight depression, rapid recovery, no anaphylaxis.
Guinea Pig XVI	Normal control, no previous sensitization.	Injected in heart 1 c.c. of horse serum.	Slight depression, rapid recovery, no anaphylaxis.
Guinea Pig XVII	Sensitized by injecting daily 0.5 c.c. subcutaneously for 7 days.	Injected subcutaneously after rest of 10 days 1 c.c. of horse serum.	Sneezing, scratching of nose, paresis of hind legs, bronchial breathing, twitching of muscles.
Guinea Pig XVIII	Sensitized by injecting daily 0.5 c.c. subcutaneously after 7 days.	Injected intraperitoneally after 10 days' rest 1 c.c. of horse serum.	Sneezing, scratching of nose, paresis of hind legs, bronchial breathing, twitching of muscles.
Guinea Pig XIX	Injected slowly 1 c.c. horse serum into heart.	Injected 1 c.c. in heart after rest of 10 days.	Convulsions and death in 5 minutes.
Guinea Pig XX	Injected slowly 1 c.c. horse serum into heart.	Injected subcutaneously after 10 days' rest 1 c.c. of horse serum.	Bronchial breathing, depression, sneezing and rubbing of nose, paresis.

*per vaginam* was exactly the same as the classic picture of anaphylaxis obtained by direct injection of horse serum into the tissues with a needle.

The progressive symptoms obtained in most of the animals were as follows. When the guinea pigs sensitized *per vaginam* were injected with the antigen, one of the earliest signs noted was a peculiar twitching of the muscles of the abdomen and of the posterior portions of the body. Sneezing and rubbing of the nose occurred in almost every experiment. In some cases the rubbing or scratching of the nose was very violent. The animals had a tense and watchful appearance, the eyes in many cases showing a definite protrusion. One of the most



characteristic signs of anaphylaxis noted in these experiments was the peculiar respiration. The respiration became deeper and jerky, in other words, there was dyspnea. On listening to the breath sounds with a stethoscope definite wheezing and bronchial breathing were heard. Such was not the case in normal control animals. These first signs of shock or anaphylaxis were followed by spasmodic movements throughout the body. There was a noticeable twitching of the jaw muscles, the animals were depressed and were lying down on the side and a definite weakness and even paralysis of the hind legs was noted in severe cases. These signs and symptoms in some of the animals were followed by generalized convulsions and finally death. A peculiar early symptom noted in some of the animals was a twitching or twirling or flopping of the ears. The gravity or severity of the symptoms varied. It was greater in the animal injected with the antigen directly into the heart, and it was not as severe when a smaller dose of the antigen was administered. The most remarkable feature of the whole injection was that in every one of the ten experiments made there were definite signs of anaphylactic shock; which proved conclusively that the introduction of the serum into the vagina was followed by more or less absorption of the foreign protein by the animal.

#### DISCUSSION

About ten years ago I published a study concerning absorption of drugs and poisons through the vagina in which I showed that a large number of drugs, alkaloids, inorganic salts, organic esters, antiseptics, can be and are easily absorbed through the vaginal wall. Such experiments were conducted by physiologic and chemical methods.<sup>2</sup> A review of the clinical and toxicologic literature made in that connection revealed also that poisoning through the vagina in humans of a grave character is not at all rare. Recently Robinson reported and confirmed some of those findings and also found some other drugs which are easily absorbed through the vaginal mucous membranes.<sup>3</sup> The results of the present investigations indicate that not only can drugs and poisons in the accepted sense of the words be absorbed through the vagina but also various proteins and more particularly blood serum. Sewall in the work quoted above found that he could not only produce allergic symptoms by nasal sensitization of his guinea pigs but that by selecting the proper dose and the amount of antigen given as well as spacing the period of rest, he could produce also a protective action in some of his animals. This, of course, is quite logical and in line with other experiments in anaphylaxis and immunization work. In the present investigation the author did not carry out any extensive observations along this line, but a few experiments made by introducing very small quantities of serum for long periods of time seemed to indicate that such a protective action was occasionally produced. The present investiga-

tion is of interest not only from the physiologic and pharmacologic point of view, but also from the standpoint of social hygiene and eugenics. The above experiments seem to demonstrate that normal physiologic cohabitation is essential for the fertilization of the ovum but also is conducive to "merging" or "union" of the mates in a larger sense of the word, for the experiments made on guinea pigs using horse serum as an antigen have shown that such guinea pigs can be sensitized by the instillation of the serum into the vagina.

## REFERENECS

(1) *Sewall, Henry*: Science, October, 1925, lxii, No. 1605, 293-299. (2) *Macht, D. I.*: Jour. Pharmacol. and Exper. Therap., 1918, x, No. 7, 509. (3) *Robinson, G. Drummond*: Jour. Pharmacol. and Exper. Therap., 1927, xxxii, No. 2, 81.

3420 AUCHENTOROLY TERRACE.

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## MESENTERIC LIPOMATOSIS AND MEGACOLON, WITH MUSCULAR ATROPHY OF THE ABDOMINAL WALL\*

### REPORT OF A CASE

BY WALTER T. DANNREUTHER M.D., F.A.C.S., NEW YORK

MRS. E. J., aged forty-four, was referred with a diagnosis of ovarian cyst, lipomatosis of the abdominal wall, and umbilical hernia. The patient entered the Post-Graduate Hospital on January 6, 1927, but in view of the fact that I could not verify the diagnosis of ovarian cyst, and a careful preoperative study of the patient seemed desirable, operation was deferred until January 11th. The essential points in the history and physical examination are as follows:

The family and previous personal history are irrelevant, except that the patient survived an attack of lobar pneumonia three years ago. Menstruation was established at sixteen, and has always been characterized by long intermenstrual intervals, varying from four to twelve weeks. The flow has been painless and of seven days duration from the time of onset. She married young, bore five children normally, had no miscarriages, and never complained of pelvic symptoms. For the past eight years there has been a gradual, persistent, symmetric, painless enlargement of the abdomen, which finally attained such great size that the weight of the pendulous overhang caused the patient to fall to the floor or street on several occasions. She was never comfortable in any position, and readily accepted the suggestion of operative interference. She did not suffer from constipation, backache, headache, dyspnea on exertion, edema, nervousness, palpitation, or any other symptom of consequence.

On physical examination, the nutrition and muscular development of all parts of the body other than the abdomen seemed normal in every respect. There was no evidence of emaciation or edema. Weight 172 pounds; height 151.5 cm.; pulse 80; blood pressure 134/78; urine findings normal; blood count showed 4,430,000 red blood cells, 10,600 leucocytes, and a normal differential count; phenolsulphone-phthalein test demonstrated excellent renal function; chemical examination of the blood revealed normal urea nitrogen, sugar, chlorides, and carbon dioxide combining power; basal metabolism thirteen-plus.

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\*Read before the New York Obstetrical Society, January 10, 1928.

The abdomen appeared excessively obese and overhung the pubes to a considerable degree (Fig. 1). The entire surface was somewhat tense without much thinning of the overlying skin. The umbilicus was flattened and rather prominent, suggesting the probable existence of a small umbilical hernia. On deep palpation a non-sensitive, indefinite mass could be palpated just below the umbilical region, which seemed rounded and mobile. It did not have the definite outline of an ovarian cyst, however, and could be displaced but very little (this was probably the omentum). The abdominal wall could not be picked up by the examining hand, and gave the impression of tremendous thickness. Roentgen-ray examination of the gastrointestinal tract revealed nothing significant except what was interpreted as a general atony and dilatation of the colon.



FIG. 1.

The contemplated operative procedures consisted of a wide lipectomy of the abdominal wall, repair of the umbilical hernia, and a thorough intraperitoneal exploration. Hence, my first incision was a generously wide transverse cut across the entire width of the abdomen, which was intended to be the upper limit of the resection of fat in the abdominal wall. Before I realized it, the scalpel had traversed the skin, fascia, and parietal peritoneum, deeply wounded the omentum, which fortunately lay immediately beneath the line of incision, and nicked the descending colon. The entire density of the abdominal wall was then seen to be no more than half an inch in thickness, and not a trace of muscle fibers could be found from flank to flank. The omentum was somewhat short and contained an average amount of fat only. The intraperitoneal exploring hand discovered the

diagnosis of umbilical hernia. The entire colon was huge in size, and its walls were greatly hypertrophied, but no redundancy was apparent. The mesentery everywhere contained large masses of fat and constituted the greater part of the bulk of the abdominal contents. After carefully repairing the wounds in the descending colon and omentum, the pelvic organs, stomach, gall bladder, liver, spleen, and kidneys, in turn were systematically palpated, without discovering any further abnormality. The long transverse abdominal incision was closed in layers. The patient was confined to bed for eighteen days and discharged from the hospital four days later. During the postoperative period, a neurologist and an internist were invited to see the patient in consultation, but neither one offered any diagnostic or therapeutic suggestions.

Since the operation last January, a further increase in the size of the abdomen has added to the patient's distress, and I must confess to a sense of humiliation that I subjected her to an unnecessary operation and can contribute nothing to her comfort now. The preoperative diagnoses of lipomatosis of the abdominal wall and umbilical hernia were both wrong, and the correct pathologic diagnosis is mesenteric lipomatosis and megacolon, with muscular atrophy of the abdominal wall. It is logical to presume that the adiposal dystrophy is due to a pluriglandular endocrine disturbance, with probably a definite hypopituitarism as the chief factor. I admit, however, that I am at a loss to explain the biochemical factors which were responsible for this acquired anomaly, and am entirely in the dark concerning the remedial measures which might relieve this patient's physical discomfort.

580 PARK AVENUE.

(For discussion, see page 286.)

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## REPORT OF A CASE OF CONGENITAL SEXUAL ANOMALY DEVELOPMENT\*

BY MARY PAULINE JEFFERY, M.D., VELLORE, SOUTH INDIA

(*Professor of Anatomy, the Union Missionary Medical School for Women*)

A YOUNG man, a native of Southern India giving his age as eighteen but appearing not more than fourteen, complained of pain in the region of the left inguinal canal. The pain was not severe and had been present for several years. No other significant facts were elicited in the history.

On general examination the boy appeared to be several years younger than his declared age. The distribution of body hair, the voice, and other secondary sexual characteristics were of the masculine type. The penis was normal and erection was declared to take place. Palpation of the scrotum showed what at first seemed like three well-formed testicles in the left side, with none in the right. Undescended testicles could not be palpated but there was an indefinite elongated mass in the left inguinal canal. The three objects in the left half of the scrotum were freely movable, but not tender, and were connected to each other and to the contents of the inguinal canal by cord-like structures. A cord on the right side was felt for a short distance below the pubes, but ended in a mass of tissue so small as to be scarcely palpable. Rectal examination did not show evidence of intrapelvic testicles or other anomalies. A preoperative diagnosis was not made.

At operation an incision was made over the left inguinal canal as for hernia, and was prolonged downward to expose the scrotal contents. The three objects mentioned then appeared to be a complete set of female genitals, with very large ovaries and a small bicornate uterus supporting two small fallopian tubes about

the length of testicles or ovaries (about 3.8 cm.). The cervix was not evident as such, but the cord-like mass running up into the inguinal canal corresponded to the position of the cervix and vagina of the small inverted uterus upside down in the serotal sac. The surgeon, believing the glandular structures to be ovaries, removed the entire mass. The patient was dismissed twelve days after operation, free from symptoms. The specimen was sent to the Cole Hospital Laboratory at Vellore for examination.

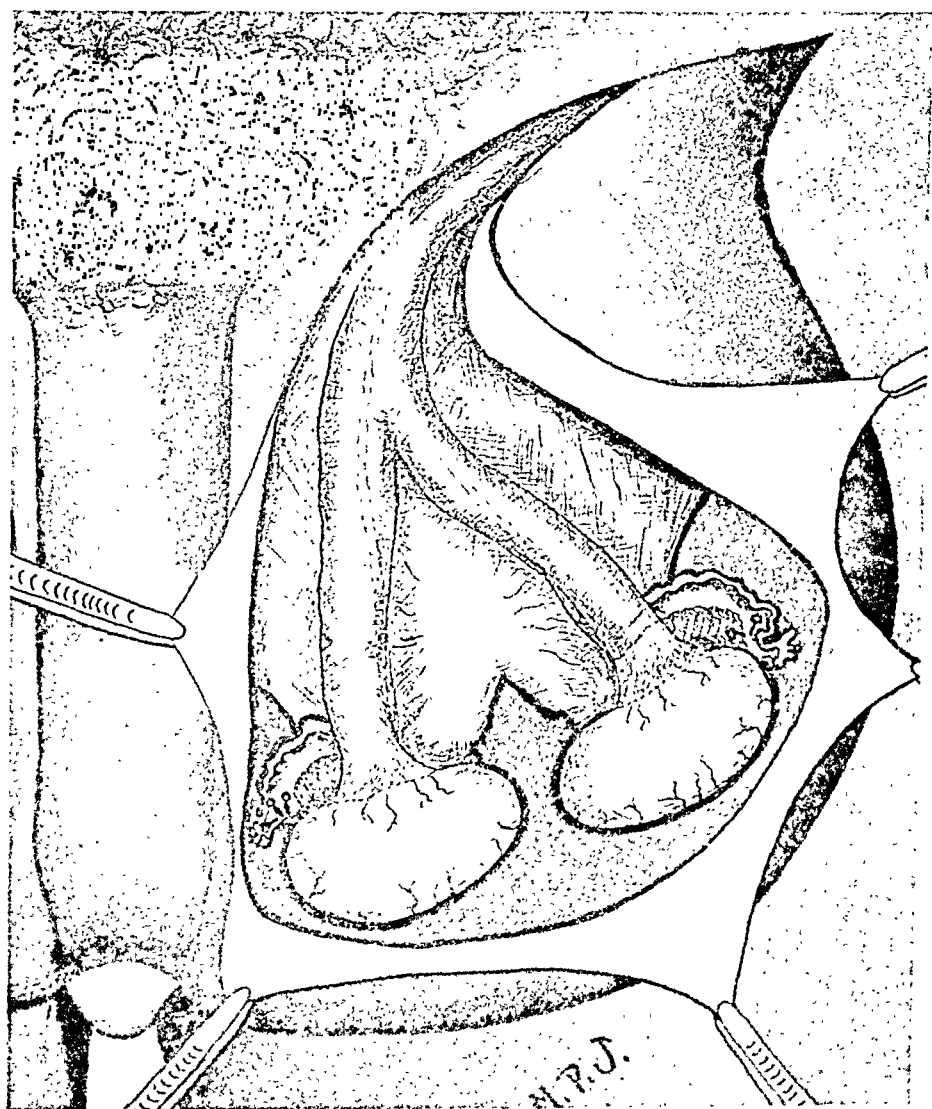


Fig. 1.—Left side of serotum opened, showing dorsal surface of uterus and testes, also hydatids of Morgagni.

The uterus was covered with serous membrane resembling its usual peritoneal covering and this was reflected in one pair of folds suggesting broad ligaments and another pair of folds enclosing the little fallopian tubes which were about 3.5 cm. long and could be probed as far as the horns of the little bicornate uterus, but not into the fundus. The membrane was continuous from the surface of the fallopian tubes to its attachment to the longitudinal aspect of the glandular masses, lying parallel to the tubes. The bicornate uterus was found to contain only one common lower uterine segment. Running parallel with the cord like mass leading up into the inguinal canal, were a pair of ducts containing a whitish secretion.

These could be probed for a distance of 10 cm. and when the overlying membrane was dissected away, they were found to run along the lateral aspects of the uterus but quite distinct from it. They terminated, under cover of the fold of membrane enclosing the fallopian tubes, in a linear attachment to the glandular structures and at this attachment the small vasa deferentia of an epididymis could be seen.

Microscopic sections of glandular structures proved that they were not ovaries

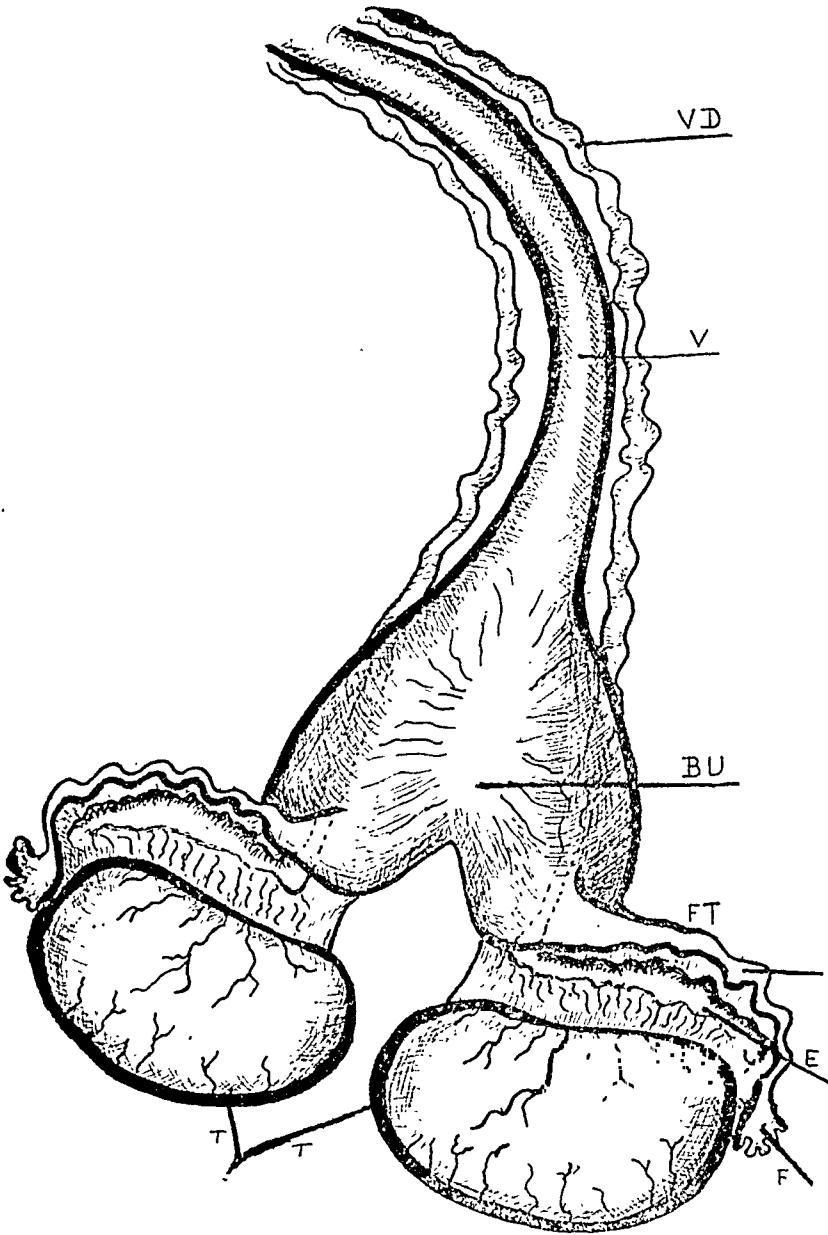


Fig. 2.—Ventral aspect of excised specimen. *VD*, vas deferens; *V*, vagina, solid cord; *BU*, bicornuate uterus; *FT*, fallopian tube; *E*, epididymis; *F*, fimbria; *TT*, testes.

but testicles. The ovoid bodies were about 3.8 cm. long, round, instead of flattened and firm and yellowish. Fine blood vessels were distributed over their surfaces radiating from the region of attachment to the epididymis.

This anomaly represents simultaneous development of uterus, tubes, vas, epididymis, and testes, with normal appearing external male genitals and with no testicle on the right side, the entire mass being in the left scrotal sac.

*Postoperative Notes.*—After the operation, performed on July 20, 1927, the convalescence in the hospital was uneventful. On March 17, 1928, eight months after operation, the boy was called back from his village for a follow-up clinic, and found to be in excellent health, free from pain. Examination of the genitalia showed a normal penis, except for severe scabies; an empty scrotal sac with a well-healed postoperative scar on the left, and no hernia. The pubic hair was scanty, but no more so than before operation, and still of the male type of distribution. There was also no change in the hair distribution of the rest of the body. There were no observable postoperative changes in the breasts, habitus, or voice of the boy, and he seemed quite bright and active.

## A REPORT OF TWO CASES OF PNEUMOCOCCIC PERITONITIS FOLLOWING NORMAL LABOR

BY J. R. McCORD, M.D., ATLANTA, GEORGIA

(From the Department of Obstetrics, Emory University School of Medicine)

IN THE *Journal of Obstetrics and Gynecology of the British Empire*, Vol. xxxiv, No. 4, Harold F. Seymour reported "A Case of Pneumococcal Peritonitis During the Puerperium, With Recovery." He stated that he was able to find only one other case reported in the literature. His contribution leads me to report the following two cases.

CASE 1.—A negress, E. C., primipara, aged eighteen, was admitted to the obstetric ward at 7:10 P. M., April 25, 1925, in active labor. Her temperature, pulse, and respiration were normal; a Wassermann test was negative. Her previous history was negative. Labor was completed fifty-six minutes after admission to the hospital. During labor no vaginal examinations were made, and she had only two rectal examinations. She was delivered of a seven pound, three ounce baby, no perineal tears resulting. A small amount of ether was given during the passage of the head over the perineum; this consumed from four to five minutes. The placenta was delivered by early expression four minutes after the birth of the baby, the patient having had an injection of one c.c. of pituitrin. She was returned to the ward with normal temperature, pulse, and respiration.

On the third day postpartum, April 29, the patient complained of pain in her abdomen. Her temperature at this time was 103.2°, pulse 128, and respiration 30. This was the first elevation of temperature, pulse, and respiration she had. At this time a blood count showed 19,000 leucocytes, 85 per cent polymorphonuclears, 12 per cent small lymphocytes, and 3 per cent large lymphocytes.

On May 1 her temperature, pulse, and respiration had all increased, and her temperature, thereafter, was very irregular. She had no nausea or vomiting, no sore throat, no breast trouble, nor were there any bladder symptoms. There was slight tenderness over both kidneys. Her abdomen was slightly distended, and there was some tenderness and rigidity over the entire abdomen but more marked below the umbilicus. There was no dullness in the flanks; her uterus was very tender. Just before the first elevation of temperature she had a slight chill. The findings were very suggestive of an early peritonitis. On May 2, a blood culture was taken.

Under novocaine anesthesia the abdomen was opened, and a large amount of greenish-yellow pus was expelled. Recent adhesions were all over the abdomen.

The omentum was well down in the abdomen and was adherent to the intestines and uterus. A tube drain was placed behind the uterus and a Penrose drain in each iliac fossa. A smear was made of the pus obtained. Death occurred at 9:45 P.M., May 3, 1925.

The necropsy was confined to the abdomen. Upon opening the abdomen a moderate amount of greenish yellow fluid escaped. A thick gelatinous fibro-purulent exudate covered the peritoneum and intestines. The omentum was well down in the pelvis, completely covering the uterus and intestines. The spleen was considerably enlarged, an acute splenitis. The uterus reached two centimeters below the umbilicus; the surface was reddened and there were subserous hemorrhages. The endometrium was necrotic, and the cavity of the uterus was filled with a dark brown exudate. The cause of death was given as general peritonitis.

The blood culture was positive for pneumococci. The smear taken at the time of operation and the spear taken at necropsy were both positive for pneumococci.

CASE 2.—A negress, R. J., primipara, aged eighteen, was admitted to the obstetric ward at 8 A. M., May 22, 1925. At this time she was in active labor; her temperature, pulse, and respiration were normal, and her Wassermann reaction was negative. Her previous history was irrelevant. She was delivered of a living baby girl, weighing five pounds, eight and one-half ounces, no perineal tears resulting. Three rectal examinations were made during labor; she did not have a vaginal examination. No anesthetic was given. The placenta was delivered normally after the patient had an injection of one c.c. of pituitrin. She was returned to the ward with normal temperature, pulse, and respiration.

On May 23, just twelve hours later, she complained of pain in the abdomen and of being cold. At this time her temperature was 103.2°, pulse 108, and respiration 26. A blood count showed 16,500 leucocytes, 95 per cent polymorphonuclears, 4 per cent small lymphocytes; and 1 per cent large lymphocytes. A blood culture was made. The patient was in a semistuporous condition; her abdomen was slightly distended, with some tenderness over the entire abdomen but more marked over the lower quadrants. There was a slight dullness in the left flank and tympany elsewhere. A few moist râles were heard at the bases of the lungs. She died at 2:25 A.M., May 27, 1925.

The cause of death as reported from the necropsy was general peritonitis. The anatomic diagnosis was: (1) endocervicitis, (2) endometritis, (3) salpingo-oophoritis bilateral, (4) general peritonitis, (5) petechial hemorrhages in the lungs, (6) fibrinous pleuritis, right, (7) acute splenitis, (8) passive hyperemia and cloudy swelling of the liver and the kidneys. The blood culture was reported as pure pneumococci.

At about this time two or three other deaths, with the same general symptoms, but in which no positive blood cultures were obtained, occurred. On no case was a vaginal examination made. All labors were easy ones, with no perineal tears.

131 FORREST AVE., N. E.



## A CASE OF OVARIAN PREGNANCY OF FIVE MONTHS' DEVELOPMENT

By G. VAN AMBER BROWN, M.D., DETROIT, MICH.

A PRIMARY ovarian pregnancy is the result of fecundation of the ovum while still within the graafian follicle. Examples of such a condition are sufficiently uncommon that all are worthy of being placed on record. The conditions which must be fulfilled in the specimen in question is to be regarded as one of proved primary ovarian gestation.

Ovarian pregnancy appears to have been first described by Mercerus in 1614. An important monograph on the subject was written by DeSanetis Maurice in 1862, and was translated into several languages. Although cases were reported from time to time, there was no evidence to distinguish them from tubal pregnancies.

Kower presented before a gynecologic society, a specimen of ovarian pregnancy, a summarized pathologic report of which was later published by Dr. Catherine Van Tussenbroek (*Central-blatt für Gynäk.*, 1897). This is in fact the first positive case on record and was later (1899) thoroughly described and carefully studied anatomically by Dr. Van Tussenbroek. The complete description in detail of the Van Tussenbroek specimen proved beyond a doubt the real condition and served as a guide for further observations. Spiegelberg, as far back as 1878, was the first to suggest certain factors of identification: (1) The tube of the affected side must be intact. (2) The fetal sac must occupy the position of the ovary; (3) it must be connected with the uterus by the uteroovarian ligament; (4) definite ovarian tissue should be found in the sac wall. These requirements were later considered insufficient, and numerous criteria have been set up by Heinecken, Williams, Werth, Norris, Caturani and Jacobson; that of Norris standing as the most complete. Can he doubt the primary development of the gestation in the ovary, because of finding of a decidual reaction in the corresponding tube? If with tubal pregnancy the opposite tube is apt to react, why cannot we obtain the same reaction in the tube connected with the pregnant ovary?

The absence of the fetus in many of the recorded cases in itself demonstrated the entire inapplicability of the criterion added by Jacobson (1908). Moreover, the histologic appearance of the ovarian tissue around certain portions of the blood-clot in the present, and also in some of the cases in the literature, would seem to suggest that it may be very difficult to find remnants of ovarian tissue at several points in a case of pregnancy which has advanced far. Hence, this criterion of Spiegelberg (1878) cannot be regarded as necessarily crucial. Whenever the implantation is developed at the outer, instead of at the inner, margin of the follicle, as in the case of Banks (1912) early destruction, even if not early rupture, of the overlying ovarian stroma and capsule would seem to be inevitable. Indeed, whenever the layer of ovarian stroma overlying the placenta is thin, very early death of the fetus would seem to be inevitable from defective nutrition alone. On the other hand, when placental development occurs in the region of the follicle directed toward the body of the ovary, great destruction of the ovarian stroma would seem to be unavoidable, even if something akin to normal decidual formation actually took

\*Read before the Fourth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, September, 16-20, 1927.

place. In the case of Engelking (1913), for example, not a trace of an ovary was found in an ovarian pregnancy which had become interstitial. Even without assuming the complete authenticity of this rather equivocal case, it would seem highly probable that the presence of ovarian tissue later in pregnancy is determined very largely by the location of the fertilized follicle within, or by the exact location of the implantation upon the ovary.

This short summary suffices to show that there is yet no consensus of opinion as to what constitutes an ovarian pregnancy. Although this fact finds its explanation partly in our lack of sufficient knowledge, it is due also to the meagerness of some of the reports. Besides, if complete disintegration and lysis of intraovarian conception can occur, then it must always remain a question of opinion in the future whether some of the cases so reported really were or were not true ovarian pregnancies. This must remain true no matter how thorough the microscopic examination, unless the clinical history or changes in the maternal organism can afford us crucial tests in such cases.

Anyone who reads far into the literature of ovarian pregnancies also must become aware of the fact that even very recently skepticism has been carried too far. Jacobson (1908), for example, placed the case of Kouwer-Van Tussenbroek (a case which finally convinced Bland-Sutton) and that of Webster (1904) in the doubtful class. Furthermore, Jacobson also insisted upon the presence of an embryo or fetus as absolutely essential. It must be emphasized, however, that even a liberal attitude on the part of a reviewer would not justify him in accepting all cases reported as genuine upon the basis of the reports themselves, for they, especially the older ones, often are too meager to enable one to form a reliable opinion. From evidence contained in literature, it is clear that further reports of single cases are not needed for the purpose of emphasizing the occurrence of ovarian pregnancy. Yet such reports nevertheless may help in the determination of the relative frequency of this novel and sinister condition, and also throw further light upon its genesis and the finer relations of the implantations, as well as upon other matters. Moreover, since the cases which are accompanied by a careful histologic examination and which for this reason alone are wholly unequivocal from an anatomic standpoint still are relatively few, the report of an additional scrutiny of the titles listed for the last decade reveals the fact that 5 cases of ovarian pregnancy were reported in 1908; 4 each in 1909 and 1910; 7 in 1911; 13 in 1912; 9 in 1913; 7 in 1914; 3 in 1915; 1 in 1916; 5 in 1917. This makes a total of 58 cases apparently reported within this decade. Lockyer (1917) as stated above accepted as authentic only 22 cases of those reported between 1910 and 1917, but his review is only a partial one. Even so, it shows that there is a decided increase in the number of cases which have been regarded as genuine from decade to decade. Williams (1910), as mentioned before, found only 13 positive cases up

to 1906; whereas, Norris found 19 positive cases in the single decade 1899 and 1909. That is, Norris found more positive cases reported in this decade than had been reported in all previous medical history up to 1906. This is surely a significant fact.

Schumann in his monograph on *Extrauterine Pregnancy* (1921) quotes Norris' collection of 19 positive cases from the literature up to 1909. From 1909 to 1917, Lockyer accepts 22 cases. A case reported by Meyer and Wynne in 1919 is accepted by Lockyer, bringing the total up to 42. A review of the literature from 1919 to 1926, by H. V. Vineberg, shows 17 cases reported in which he states that "all but three fulfilled the criteria of authentic cases of ovarian pregnancy, thus making a total of 14 cases for that period." On May 11, 1926, he reports his case which makes a total to that date of 57 authentic cases.

In 1926 there are five additional cases, four of which have been reported in the literature. Regarding these there has been no critical study published as to whether they are to be classed as doubtful or accepted as proved; the fifth for 1926 is my case which I herewith report.

Mrs. C. S., Mexican, housewife, age 32, well developed, fairly well nourished, married 17 years; had never been pregnant. Menses began at 17 years, always regular; 28 day type. Flow profuse, 6 days, no pain. Last period February 3, 1926. General health has been fairly good; no operations. Chief complaint, enlargement of abdomen of eight months' duration.

Patient was fairly well until February, 1926, when she developed a severe pain in the lower abdomen. For three months she was nauseated and vomited a great deal and had pain in the abdomen ever since. She did not menstruate from February until July. On July third, patient entered the hospital with the diagnosis of pregnancy. She had some vaginal bleeding, but it was not like a normal menstrual flow. She complained of considerable pain in her abdomen and vomited everything taken by mouth. There was marked tenderness over both iliac regions and her abdomen was tender throughout. The uterus was thought to be palpable up to one inch above the iliac crests. RBC 2,840,000. WBC 8600. Poly. 68. SL 18. LL 10. M 4. Urine negative for albumin and sugar. She remained in the hospital for seven days, during which time her temperature rose as high as 101°. X-ray examination revealed no evidence of pregnancy. When discharged from the hospital she was much improved; nausea and vomiting ceased. The abdominal tenderness and rigidity had disappeared. At present (October 13, 1926) she sleeps well and her appetite is good; constipation marked and there is frequent urination; abdominal pain is marked. Patient reentered the hospital on this date, complaining of abdominal soreness and a continued bloody vaginal discharge, having an offensive odor. The general condition of patient was quite good. Abdominal examination revealed a large tumor, regular in outline, centrally located, occupying nearly the whole abdominal cavity with margins of the abdomen above, below and laterally free from tumefaction. Oct. 14, 1926. RBC 4,890,000. WBC 7700. Urine SG 1013. Sugar negative, albumin trace. Microscopic, epithelium and pus cells with bacillus coli. Diagnosis, ovarian cyst.

Operation October 14, 1926. A median incision was made extending from the pubis to an inch above and to the left of the umbilicus. A large tumor was found

which on its anterior surface was, by mass adhesions, firmly attached to the anterior parietal peritoneum, on the inferior surface, also laterally it was firmly adherent to loops of intestine. On the superior surface it was adherent to the omentum. The entire mass was surrounded by dense adhesions. On freeing these the tumor was delivered and found to be attached by a long, quite narrow and thin pedicle to the left cornu of the uterus. This pedicle was unmistakably the uteroovarian ligament. Attached to the mass on the anterior inferior portion and about 5 cm. from the attachment of the pedicle of the tumor, the central portion of the left oviduct, which was intact, was attached to the tumor wall covering an area 0.5 by 1 cm. By this adhesion the tube was kinked. The tube was apparently somewhat lengthened, its fimbriae free, and distant from the tumor mass. The right tube was macroscopically normal in appearance, except that the blood vessels were engorged. The right ovary was not macroscopically pathologic; the uterus was boggy and retroflexed with the fundus low in the culdesac. The tumor mass was high in the abdomen, leaving considerable distance between the uterus and tumor. The tumor having been freed from the adherent structures, which was accomplished with great difficulty, the pedicle was ligated, severed, and the mass removed. The abdomen was closed in layers using No. 1 catgut chromic, throughout, except that clips were used for the skin.

Examination of the specimen after its removal showed what was apparently a large simple ovarian cyst, 24 cm. in diameter (fresh specimen), with a portion of the round ligament attached; also a small portion of the oviduct, which though quite normal in appearance was firmly attached to the cyst wall.

#### PATHOLOGIST'S REPORT

The specimen (formalin fixed) was a well rounded mass of tissue, 14 cm. in diameter with an external surface closely comparable to that of a thin cyst wall. Distributed over the peripheral surface were numerous small blood vessels. Upon one side was a folded portion of an oviduct with a diameter averaging 1 cm. At a distance of approximately 4.5 cm. from the oviduct was a small bit of firm tissue resembling the round ligament. Close examination of the peripheral surface of the sac suggests varying degrees of density of the wall. The bisected internal surfaces show contents consisting of a fetus 22 cm. long occiput-foot measurement. The attached umbilical cord was 19 cm. long; the fetus, a male of apparent normal development, but now showing early mumification changes. The cord attachment was peculiar because of firm fixation against a thinned-out portion of the sac wall, fully 3 cm. away from the placental mass. Vessels extend from the placental margin across to the attached surface of the cord, making the identification of membranous marginal union with the placenta proper. The cubical area of the space occupied by the fetus and that occupied by the placenta were approximately equal. The amniotic membrane was intact and lined the fetal partitional area. The placenta was extensively hemorrhagic. The hemorrhagic material was between the outside surface of the amniotic sac and the internal surface of the main sac wall, and exhibited some smoothly molded masses beneath the amnion projecting close against the fetus.

A large number of microscopic sections were taken from the placental portion, the sac wall and the umbilical cord attachment site. In all sections examined there was no formation of decidua. The inner surface of the sac wall exhibited a reaction of a typical chronic inflammatory type. The entire wall was closely compacted and quite generally atrophic. The cell nuclei showed marked irregularity of sizes in places having the appearance of laking. The assembling of the cells offered the same pattern of architecture found in ovarian stroma after its subjection to

marked pressure changes. In places definite well preserved areas of interlacing unit structures were plainly discerned. The better preserved portions of the wall had the staining characteristics of compact ovarian stroma. In one section cut from the oviduct wall, to which is attached part of the clotted blood, there were definitely well preserved muscle bundles. The oviduct was infected and imperfectly canalized. In all sections upon the inner surface of the sac wall could be seen attached placental tissue and clotted blood. The attachment therefore includes both ovarian and oviduct tissues. The placental tissues in all sections were necrotic. The greater part of the red blood cell clot showed complete hemolysis. The epithelium of the chorionic villi stained deeply with hematoxylin and in places showed calcium deposition. In one portion of the sac wall there was a large thrombosed vein.

*Diagnosis:* Ovarian and tubal pregnancy. The fetal newgrowth is primarily ovarian in genesis; the enclosing sac wall being chiefly ovarian structure. (James E. Davis, pathologist.)

#### SECOND PATHOLOGIST'S REPORT SUPPLEMENTING FIRST

A section across a tubular structure showed the typical arrangement of muscle in layers comparable to the arrangement found in the oviduct. The structure varied from normal in that there was no single lumen with mucosa thrown into folds or plicae; instead there was a scattering of multiple small tubules with smooth muscle bundles interspersed between them. The epithelial cells were columnar and arranged in a single layer. There was no change suggestive of a decidual reaction nor one comparable to a pseudodecidual reaction in the mucosa. The multiplicity of tubular spaces interspersed with muscle indicates an anomaly in development of the oviduct. There was some congestion of passive character and focal mononuclear cell infiltration. There was no ovarian tissue seen at the margin of the tube.

A section through the wall of the encapsulated pregnancy showed on its external surface tissues characteristic of ovarian cortex with fine millet seed type of stromal cell, the typical architectural arrangement, and a few hyalinized acellular fibrous bodies of corpora albuginea origin. No primordial or graafian follicles were present. The ovarian tissue showed great compaction and simple pressure atrophy, the zone occupied by ovarian cortex being but a millimeter or so in thickness. Beneath this cortex there was a loose spongy fibrous tissue zone of highly vascular character, the vessels being irregular, thin walled and flattened from internal pressure. Progressing inward there was a wide zone of tissue composed of hyalinized fibrous tissue infiltrated with some mononuclear cells and cells suggestive of trophoblastic origin, though markedly degenerated. The inner surface of the wall showed highly atrophied and degenerated chorionic tissue with fibrin and ghosts of chorionic villi in an almost formless layer.

Other sections taken through the wall at various sites showed no recognizable ovarian tissue. There must be kept in mind however that an implantation of a pregnancy in the broad ligament may cause a stretching out of ovarian tissue in the external surface of the tissues enveloping the pregnancy and the ovarian tissues would tend to be localized in one part of the wall.

In this case the ovary, distant from the uterus, unruptured and containing the fetus, the placenta attached within the ovarian structures, each tube intact and the fimbriae free makes the gross anatomic diagnosis perfectly easy. Acceptance of the microscopic diagnosis is also warranted as the evidence is in every way confirmatory, especially that ovarian tissue is found in numerous areas throughout the sac. Also, there is no fusion of the oviduct with the pregnancy mass, and in the mass chorionic tissue with ghosts of chorionic villi are demonstrable. Thus, the combined evidence of the gross and the microscopic fulfill all the requirements for a justifiable diagnosis of ovarian pregnancy.

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# Department of Maternal Welfare

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CONDUCTED BY FRED L. ADAIR, M.D.

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## FIFTH ANNUAL CONFERENCE OF STATE DIRECTORS OF MATERNITY AND INFANCY WORK, WASHINGTON, D. C., APRIL 2-5, 1928

Abstracts of some of the papers read at the Fifth Annual Conference of State Directors of Maternity and Infancy Work, held at Washington, D. C., April 2-5, 1928, are herewith presented.

### **Maternity Care in Hospitals, Ralph W. Loberstine, New York City.**

The average type of obstetric case can be conducted safely in the home under trying circumstances and amid none too clean surroundings, provided the medical attention and nursing care are good. Pregnancy and childbirth are frequently complicated, and first class care is difficult to obtain in the homes.

The abler obstetricians agree that abnormal pregnancies, first labors, and all abnormal labors would be best handled in hospitals. This requires a greater number of maternity beds and of trained obstetricians. Many cases complicated by toxemia or bleeding could be hospitalized and carried to a period of fetal viability.

There should be a certain amount of follow-up care in the home for hospital cases. This should be carried on by prenatal and postnatal clinics connected with the hospitals or by organizations closely affiliated with them.

Maternity hospital service should permit of emergency obstetric operation, on short notice, day or night. Rectal examination is preferable and yet is not harmless and allows more mistakes in diagnosis. Sterile gloves should be used.

There should be thorough preparation of the field of delivery and aseptic technic throughout. In a general hospital there should be no interchange of personnel or equipment between the maternity and other parts of the hospital. Infected cases should be segregated and if possible have separate equipment and personnel.

There is danger of infection for the babies from overcrowding and from attendants who harbor infections.

In rural communities one solution of the problem of better maternity care seems to be the building of more county hospitals. They should have proper equipment and personnel trained for maternity work.

### **Home Deliveries, James R. McCord, M.D., Atlanta, Georgia.**

Whatever advance is made in the practice of obstetrics will be due probably to recent graduates in medicine who have had good training. If the basic principles of the science of obstetrics have been thoroughly mastered, the technical details of the delivery will become of minor importance, whether the delivery is at home or in a hospital. Operative work should be hospitalized; but knowledge of the mechanics of labor is as important for normal as for abnormal cases. The general surgeon's lack of such knowledge may be responsible to some extent for the great number of cesarean operations.

If medical schools have weak obstetric departments and cannot give their students generous practical work under careful supervision, their graduates cannot be expected to practice obstetrics carefully. If the graduates know more about obstetrics, they will be eager to make it their specialty. Putting obstetrics on a higher plane is the first consideration and is the direct responsibility of the medical schools. The physician and the laity both must be taught the dignity and complexity of the subject.

In Emory University the work in obstetrics begins with the second semester of the second year. In the third year practical instruction on these subjects is given in the prenatal clinic under the direction of practicing obstetricians. In the fourth year deliveries and ward walks are added to prenatal work and the two-hour lecture and quiz course. Groups of four students live in the hospital a total of about 30 days. The student on active duty makes examinations when a case is admitted, filling out a detailed record. He is not allowed to leave the ward while a case is in labor, and 30 minute observations are charted. He delivers all the normal cases, his assistant observing and acting as anesthetist. Every case of labor, day or night, is witnessed by a graduate intern who also charts a brief summary. No vaginal examination may be made or pituitrin given unless the resident physician has seen the case and given his consent. The examination is made under supervision after the student has been instructed as to the proper method. The student also makes rounds with the resident obstetrician, charting his observations. The assisting student does the laboratory work of the ward. These four students work in the prenatal clinic, reviewing by actual work the diagnosis of pregnancy, position, and presentation, learning more as to pelvic contraction and the toxemias of pregnancy, and assisting in the prenatal syphilitic clinic.

In 15 years no student has failed in senior obstetrics. In the past year 1,180 women were delivered, 869 of whom attended the prenatal clinic. The operative incidence was 0.4 per cent, the mortality 0.8 per cent. In the past six years only 10 cesarean operations have been performed for some 6,000 to 7,000 deliveries. The mortality, morbidity, sepsis, eclampsia, positive Wassermanns, and stillbirths are decreasing.

### **Training the Public-Health Nurse for Rural Maternity Work, Miss Hazel Corbin, New York City.**

Schools of nursing teach practically nothing about care and supervision during pregnancy, though the better schools are attempting to remedy this by instruction through prenatal and postnatal clinics.

The nurse's duties, though differing with the medical and nursing facilities available in different communities, may include:

- (1) The mother's hygiene, nutrition, exercise and rest, and their adjustment to the family routine.
- (2) Preparation for the baby; clothes, bed, toilet supplies, and care of toilet supplies.
- (3) Care of the baby; bath, exercise, food, rest, adjustment of his daily routine to that of the family.
- (4) Observation of the mother; ascertaining discomforts and symptoms needing attention, making urinalyses; taking blood pressure.
- (5) Keeping the physician or hospital informed by sending detailed report of each visit with findings and advice given.
- (6) Helping the physician at delivery and giving care during the postpartum period.



The Maternity Center Association provides about three months' training in maternity nursing, attempting to give as many student nurses as possible an understanding of the development of prenatal work in relation to public health work as a whole and as one phase of preventive medicine; a realization of the nature and value of adequate maternity care and of the way to give it, and an intelligent idea of the Maternity Center Association and its relation to other organizations in the community.

Though complete maternity care can be given in rural as well as metropolitan districts, the city service permits more varied experience in a given time, costs less per patient, and probably allows planning for more fruitful conferences and lectures.

### **Rural Hospitals or Maternities of Canada, Mrs. Jean T. Dillon, West Virginia.**

As a means of keeping doctors in rural districts, the Union Hospital Act, passed eight years ago by the legislative assembly of Saskatchewan, provided for the formation of union hospital districts. The municipalities and townships in each district appoint a board of directors, and upon vote of the resident taxpayers in the district bonds are issued and a small hospital is built. It is equipped, maintained, and managed by the resident taxpayers through their representatives on the board of directors. The union hospitals may not be established where there are physicians. The directors of every hospital that has three or more practicing physicians residing within a radius of 2 miles appoint an attending medical, surgical and obstetrical staff. A hospital having 75 beds must have at least one resident intern. One bed is allowed for every 300 persons in the population, one-tenth of the accommodation to be for maternity cases, one-tenth for tuberculous patients. The hospital must comply with the "Regulations Governing Hospitals" to receive the government grant of 50 cents per patient per day.

About eight years ago the Canadian Red Cross Society organized the Red Cross Outpost Service to meet the need for nursing care in new districts opening up for immigration. The community furnishes the building, and the Red Cross equips it and for the first few months carries all financial responsibility. Then by previous agreement a gradual refund is begun. It is the policy of the Red Cross to make each outpost hospital a community center for health education. If the hospital finally is adopted as a municipal institution, the Red Cross makes a gift of the equipment. Patients who are able, pay \$3 a day; those who cannot pay are cared for free of charge. These institutions, like the union hospitals, receive 50 cents per patient per day from the provincial government.

### **Causes and Prevention of Neonatal Mortality from the Pediatrician's Point of View, Dr. Julius H. Hess, Chicago, Illinois.**

The need of understanding more clearly the etiologic factors of premature birth and the possibilities for their control has been pointed out. Conserving the life and health of the pregnant women and educating mothers of newborn infants in the essentials of child hygiene should be only the beginning of a campaign to lower neonatal mortality. The deaths of children under 1 year of age reported in Chicago declined from 66.6 per 1,000 births in 1926 to 62.75 in 1927.

Prenatal conferences are held in 17 infant-welfare stations in Chicago. Pregnant women not under a physician's care are encouraged to attend; midwives are encouraged to send their cases for examination, supervision, and advice. Urinalyses, taking of blood pressure, and Wassermann tests are a matter of routine; and

internal and external examinations and measurements are made at the first visit. If the women have not made arrangements for delivery they are advised to have a physician. If they cannot afford this, arrangements for their care are made in hospitals or for delivery at home under the care of an out-patient lying-in service. This prenatal work develops slowly; only about 1,000 new cases per year have been registered at the conferences in the three years of their existence, although Chicago has some 60,000 births annually.

For postnatal contacts the city is divided into 168 field districts in each of which a Department of health nurse is assigned to call on the mothers and babies as soon as birth reports are received. On this call the nurse emphasizes the advantages of breast feeding, advises the mother if she has difficulty in this regard, and points out the importance of regular medical supervision of the baby. This service is not rendered if the mother has a nurse or other attendant capable of rendering such service or if the family physician has indicated on his birth report that calls from the health department nurse are not desired.

Premature and congenitally diseased infants are cared for at a permanent station established in Sarah Morris Hospital in 1923. By April 1, 1928, this station had cared for 460 cases. Including those who died during the first 24 hours in the station, 62.2 per cent of the infants received before 1927 lived. 79.2 per cent of those received in 1927 lived, and 79.2 per cent of those received in 1928 to April 1 are alive. This station receives only 27.4 per cent of its cases from the hospital in which it is established.

### **Training Personnel for County Health Departments, Dr. Felix J. Underwood, Jackson, Mississippi.**

Until recently, training and experience in public health work could be obtained only in apprenticeship to some self-made health officer, as only two or three medical schools have offered a program in preventive medicine and public health. For five or six years, however, the International Health Division of the Rockefeller Foundation has assisted the Alabama State Department of Health in maintaining a training station in Covington County, Alabama (now taken over by the State Board of Health). The consequent supply of trained physicians, nurses, and inspectors has made it possible for the Alabama board of health to establish new full-time county health departments, their advantages already being accessible to more than half the entire population. For the past 3 years no county directors, nurses, nor inspectors have been appointed who had not a course of practical training for their respective duties, and this will apply henceforth to all personnel.

More recently the Rockefeller Foundation has cooperated similarly with the State Health Departments of Ohio and of Mississippi, establishing training stations in Ohio in February, 1927, and in Mississippi in July, 1927, the latter being an intensive course due to the emergency of the Mississippi River flood in May, June and July, 1927. Mississippi now has an abundance of good material for health workers for more counties and will eventually, like Alabama, take over the training of its own personnel.

### **Reduction of Infant Mortality Due to Respiratory Diseases, Dr. Howard Childs Carpenter, Philadelphia, Pennsylvania.**

Respiratory diseases as a group are second only to the natal and prenatal group of diseases as a cause of infant mortality, and their rate has risen 3.6 per cent in the period 1922-1926. The deaths reported from the four diseases in this group probably should all be ascribed to pneumonia. Classification on an etiologic basis,

as, for example, influenza-bacillus pneumonia, pneumococcus Type I, II, III, IV pneumonia, or streptococcus pneumonia, would be more helpful for prevention and treatment.

It is regrettable that public health officials have not sufficiently stressed the transmissibility of pneumonia. Isolation is advisable not only to protect the other members of the household but also to prevent them from becoming carriers and thus spreading the disease.

Hemolytic streptococci, which are the most frequent and important bacteria producing infection in the respiratory tract of infants, are found more frequently in the throats of children who have tonsils than in those whose tonsils have been removed.

A first item of education in prevention of respiratory diseases is the danger of too hot and too dry air in the home. A temperature of 65° F. with a humidity of 60 per cent will give fair safety from respiratory diseases, whereas a temperature of 72° with a relative humidity of 25 per cent will seem less warm and comfortable and will have a bad effect on the mucous membranes. The second most important item is the danger of overclothing the infant indoors—a practice especially common among the poor.

The occurrence in newborn infants of pneumonia—often incorrectly diagnosed as atelectasis—is an important reason for protecting them from sudden lowering of their temperatures. The delivery room should be warm and the infant should not be taken out of it nor bathed for at least four hours (or a longer period if the temperature is not yet normal). A suction apparatus should be at hand to remove secretions from the throat (instead of the common method of wiping out with a finger). Nurses having respiratory affections should not care for the newborn.

### Reduction of Maternal and Infant Mortality in Rural Districts

Reduction of maternal and infant mortality in rural districts, as shown by comparison of the rates during cooperation under the maternity and infancy act (1922-1926) with those for a comparable period immediately preceding cooperation (excluding 1918, when the influenza epidemic may have influenced the rate) was discussed by 11 representatives from states which have been in the United States birth-registration area long enough for comparable figures to be available from the United States Bureau of the Census; which also have cooperated from the beginning or nearly the beginning of operation of the act; and in which the greatest reductions in rural maternal and infant mortality appear to have taken place.

*Reduction of Rural Maternal Mortality.*—Dr. T. B. Beatty, State Health Commissioner of Utah, discussed the reduction of 35.9 per cent in Utah; Dr. J. H. Mason Knox, Jr., director of the Maryland Bureau of Child Hygiene, the reduction of 26.1 per cent in Maryland; Dr. Lillian R. Smith, director of the Michigan Bureau of Child Hygiene and Public Health Nursing, the reduction of 24.9 per cent in Michigan; Dr. Ada E. Schweitzer, director of the Indiana Division of Infant and Child Hygiene, the reduction of 23.9 per cent in Indiana; Dr. E. C. Hartley, director of the Minnesota Division of Child Hygiene, the reduction of 21 per cent in Minnesota; Dr. J. A. Frank, acting director of the Ohio Division of Child Hygiene, the reduction of 19.9 per cent in Ohio; Dr. Mary Riggs Noble, director of the Preschool Division of the Pennsylvania Bureau of Child Health, the reduction of 16.6 per cent in Pennsylvania; Dr. Emily Gardiner, assistant director of the Virginia Bureau of Child Welfare, the reduction of 10.9 per cent in Virginia; Dr. Elizabeth M. Gardiner, Director of the maternity, infancy, and child hygiene in

New York (whose cooperation began in May, 1923) discussed the reduction of 20.5 per cent which has taken place within New York's period of cooperation. All the speakers believed that the educational work done for improvement of prenatal and confinement care had been an important factor in the reduction of maternal mortality. Better obstetrics due to better training of physicians and the giving of more adequate prenatal care by physicians were also emphasized. Assistance from cooperating organizations and committees of lay persons that aided in establishing contacts was mentioned and the supervision and instruction of midwives in States having a considerable number of midwives. Other reasons suggested were increased hospitalization of maternity cases and extension of good highways (as lessening the inaccessibility of physicians and hospitals and facilitating the distribution of food in good condition).

*Reduction in Rural Infant Mortality.*—Doctor Noble discussed the reduction of 14.1 in Pennsylvania, Doctor Knox that of 13.3 per cent in Maryland, Doctor Schweitzer that of 12.6 per cent in Indiana, Doctor Smith that of 12.5 in Michigan, and Doctor Frank that of 12.3 per cent in Ohio. Mrs. Mary D. Davis, director of the New Hampshire Division of Maternity, Infancy, and Child Hygiene, discussed the reduction of 9.2 per cent in New Hampshire; Miss Elspeth Bennett, nutritionist of the Kentucky Bureau of Maternal and Child Health, the reduction of 8.1 per cent in Kentucky; Dr. H. Y. Richards, director of the Utah Bureau of Child Hygiene, the reduction of 7.9 per cent in Utah. These speakers mentioned among the probable causes the general educational work done, prompt reaching of parents of infants whose births were registered, extension of public health nursing, improvement accomplished in general sanitation and clean milk supply, cooperation of organized women, and the distribution of informative literature.

# Society Transactions

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## NEW YORK OBSTETRICAL SOCIETY

MEETING OF JANUARY 10, 1928

THE PRESIDENT, DR. WILLIAM P. HEALY, IN THE CHAIR

DR. W. T. DANNREUTHER reported a case of **Mesenteric Lipomatosis and Megacolon, With Muscular Atrophy of the Abdominal Wall.** (For original article see page 267.)

DR. E. W. HOLLADAY observed a similar case in Bellevue Hospital about three years ago, in which the omentum was almost six inches thick and it was impossible for the operator even to reach down into the pelvis.

DR. B. P. WATSON presented a paper entitled **An Outbreak of Puerperal Sepsis in New York City.** (For original article see page 157.)

### DISCUSSION

DR. A. C. BECK said that since the original influenza epidemic some morbidity and an occasional fatality occurred in the early spring months at the Long Island College Hospital. The nose and throat of nurses and physicians were regarded as possible carriers. All the patients who show a fever, are isolated in another ward of the hospital.

Last year three deaths occurred at a time when upper respiratory infections were prevalent, which were assumed as possible hematogenous infections from this source.

DR. O. P. HUMPHSTONE said that during the first four months of 1927, 591 patients were delivered at the Methodist Episcopal Hospital of Brooklyn with four maternal deaths due to blood stream infection. Of these patients, three were ward cases, three multiparae, three had rectal examinations, and only one had a single vaginal examination. The membranes were ruptured within four hours of delivery in all and none of the deliveries were operative. Hemolytic streptococcus was obtained from the blood of each one. The patients were removed to the isolation ward at the onset of symptoms, and although there were other patients there no new cases developed in the isolation ward. The babies of these mothers were not affected. In no other cases did he recover the hemolytic streptococcus and felt that these were individual isolated cases, that contact was no factor, that although the delivery may have played some part in the development of the sepsis, it was doubtful if the infection entered by way of the vagina. Many other cases were delivered during the same period by forceps, version, induction by bag, and cesarean section, but not one of these developed a puerperal infection. Thus he felt that he was justified in keeping the wards open and considering these deaths as due to causes over which they had no control. Dr. Humphstone believed that if they had not been using the morphine preparation for delivery, they would have had

cases of virulent sepsis in their operative cases as well and would undoubtedly have had to close the wards as was done at the Sloane.

In contrast with the above cases which undoubtedly had no definite relation to each other or to a common carrier, four babies died in one nursery, with a virulent infection. These all started with inflamed throats, three developed multiple abscesses, two had meningitis, and in three a hemolytic streptococcus was obtained from blood culture. They did not come from adjacent cribs, and no new cases developed in the isolation ward among the babies who were there at the time the babies were transferred. A night nurse who was on duty during the period in which these babies took sick developed a streptococcus sore throat and after her removal from the nursery no more cases developed. The mothers of three of these babies had normal puerperia and the fourth had a mild respiratory infection. He believed that the same bacteria took the life of these babies that caused the infection in the mothers that died; in the one case the nurse was undoubtedly the carrier and in the other the individual mothers.

DR. J. O. POLAK said that this illuminating and epoch-making study demonstrates the dangers of the eleven sources of infection, that is, the ten fingers and the nasopharynx, and it further demonstrates that these gentlemen, after all their study of the subject, know very little more about it. The most impressive points were the autopsy findings which showed that the spread of the infection was through the lymphatic channels and this is contrary to his experience. The cases autopsied at the Long Island College Hospital which died from the same condition, apparently from the same type of infection have shown the condition to be in the blood stream, originating as a thrombophlebitis and developing as a blood stream infection. It would seem that if these infections had been recognized as lymphatic primarily, that perhaps there might have been some value in drainage of the thoracic duct.

Another interesting point is the conclusion of Dr. Watson with regard to transfusion. Dr. Polak had been impressed with the fact that early and repeated transfusion has a definite influence in affecting a cure. Dr. Polak was undecided as to how the bacteria got into the vagina and blood stream even from carriers. Many times this has occurred where no examination has been made. But undoubtedly marked diminution in morbidity and mortality resulted since both mouth and nose were masked and he was convinced that this has a great deal to do with the favorable outcome of an obstetric case.

DR. R. E. STETSON said he was particularly interested in the application of transfusion, not only as a supportive, but as a curative measure. He had only this criticism, namely that the transfusion was used only as a supportive measure. For its curative effects it must be used often. The presence of the hemolytic streptococcus, above all organisms, produces the greatest hemolysis and consequently the greatest blood destruction, and one would think of transfusion in this particular infection as being a most logical mode of treatment, transfusion every forty-eight hours, and unless the patient has a very severe anemia, preferably exsanguination transfusion, taking off anywhere from two-thirds to the full amount of blood that you give, namely, removing 400 to 500 c.c. of blood and giving 500 or 600 c.c.

Dr. Stetson had treated between 40 and 50 cases of either postabortal or puerperal sepsis. The figures given in a preliminary report four years ago, where 14 cases were reported with nine recoveries and five deaths, remain about the same in this larger group of cases, about 68 per cent of recoveries. Many of those cases were late, and the measure employed early in the disease will, of course, give consequently better results.

DR. R. L. DICKINSON wanted to know if, as a means of prevention in all maternities, the throats of all attendants should be cultured once a week.

DR. G. H. RYDER asked how much of a safeguard a mask is. Suppose a person has a streptococcus in his nose and throat and then delivers a patient thoroughly and completely masked, how much danger is that patient under at the time? .

DR. WATSON, in closing, spoke as follows:

"We have come to believe very firmly that the complete masking of nose and mouth is most important. It was not carried out in Sloane Hospital until November, 1926. As Dr. Meleney has pointed out the masking was not complete as the mask might or might not fully cover the nose. Since the epidemic, we have insisted on complete masking of both mouth and nose. The regulation is being carried out to the letter in the hospital now, not only during delivery, but in the first-stage room; every one in the first-stage room is fully masked, and every nurse doing a postpartum dressing is fully masked.

"Dr. Meleney will perhaps answer the question as to how much protection that mask gives. If the individual puts on the mask and then takes it off and puts it on the reverse way, it is, of course, a menace and not a protection.

"Isolation of patients has always been carried out in Sloane Hospital. Before the epidemic, whenever a patient developed a temperature, she was isolated in a special ward and kept under close observation. Isolation regulations were carried out in the wards before the epidemic began. The regulation has been more strictly enforced since then, if that is possible.

"I may say that it was a great comfort to hear that others in New York had had a somewhat similar experience to ours, because we in the Sloane Hospital passed through a time of great trial and tribulation.

"With regard to the treatment of the cases and as to what Dr. Stetson has said with respect to transfusion, I would say that I agree with him that transfusion was not tried out in a systematic way in those cases. As I stated in the paper, if it had been begun earlier and been given more frequently in all the cases, I am quite sure that a good showing would have been made for transfusion, but quite a number of patients recovered without it, and that is all I can say about it. I don't think our figures prove anything whatever in regard to any form of treatment. It so happened that we carried out a certain line of treatment and a certain number of recoveries took place. There is no question but that the organism in this particular epidemic was an extremely virulent one. Some of our patients, one of the first patients who died for instance, had a transfusion on the second day. She, nevertheless, died on the third day. Two had transfusions done, one on the second day and the other on the second and sixth day, while others had it on the fourth, the ninth, the fourteenth, the twenty-fourth days, etc.

"We have made it an absolute rule in the hospital that no nurse is admitted unless she brings from her school a certificate of a negative culture of the nose and throat for the hemolytic streptococcus, and we are making weekly cultures of all the staff for the hemolytic streptococcus. So far this winter not a single streptococcus carrier has been found, which is very remarkable, when we compare with that the figures which Dr. Meleney gave us for last year.

"I am in agreement with Dr. Humpstone that we have not proved whether or not the first point of entry of the organism is by way of the vagina. All we can say is that the vagina was the only place where the organism was found other than in the nose and throat of carriers."

DR. MELENEY admitted the truth of the remarks of Dr. Humpstone and Dr. Polak that we have not added greatly to the knowledge of the genesis of puerperal

fever epidemics. In order to find out anything about an epidemic of this kind in its preepidemic stage, it is necessary to have in the hospital an organization which could set the stage in anticipation of an epidemic. Of course, that might be done in many hospitals and an epidemic occur where no trap was set, but at the same time something of this nature should be done in every hospital. The purpose of these suggestions is to institute measures to prevent carriers from coming into the hospital and to discover carriers who may have picked up organisms while on service in the hospital. The culturing of the staff could be done every week. Those with positive cultures could be kept away from the parturient woman just before, during, and just after labor. All that we can do under the circumstances is to minimize the opportunity of the streptococcus from coming in contact with the vulnerable uterine tissues. Unquestionably there is a seasonal variation in the incidence of the streptococcus in the nasopharynx. The incidence of the streptococcus in the surgical operating personnel of the Presbyterian Hospital was studied over a period of a year, and it was found that the incidence ran up to 25 or 30 per cent in the late winter and spring months. April and May were the two highest months. There is a gradual increase from the beginning of January until the latter part of the spring. When there are carriers about, there is a wider distribution of the organisms. If these organisms are virulent, they are going to manifest themselves in some form of an infection. Answering the question as to why the epidemic started at this particular time, one can only say that it was a combination of factors of which the chief was the occurrence of a particularly virulent organism carried by a number of persons in close contact with parturient women in a season of high streptococcus incidence. How this organism gets from the carriers into the patient is the essence of the whole thing.

Dr. Meleney continued as follows: "I cannot say anything more definite about this epidemic, but I can say very definitely about the case we had at the Presbyterian Hospital. We were having a series of very severe hemolytic streptococcus wound infections in clean cases. We made a careful bacteriologic survey and found that all of the things that ordinarily would be suspected were innocent. We found, however, a very high percentage of streptococcus carriers in the surgical personnel. We had just finished taking a complete culture of all the staff when one more case appeared in a simple hernia. On the operating team for that case there were three individuals who carried hemolytic streptococci. These persons were masking the mouth, but not the nose, and the instrument nurse was found to have the organism not only in the throat, but in the nose. Curiously enough, the patient himself had hemolytic streptococci in his nose and throat. This fact gave us the opportunity of demonstrating whether the patient had infected himself through his blood stream in the damaged tissues of the wound or whether the organism had been introduced from the outside. By serologic tests it was definitely proved that the organism from the nurse's nose and throat was biologically identical with the strain from the patient's wound and that his nose and throat strains were entirely different. The organism must have been discharged on the sterile field and then introduced into the wound. I would like very much to have the opportunity of testing out in any case of puerperal fever two strains of hemolytic streptococci, one from the nose and throat of the patient and the other from the vagina to see if the strains are identical. I feel quite certain that in this series of cases the patients did not have the organisms in their nose and throat, at least in a quantity sufficient to be obtained by the ordinary nose and throat cultures.

"It may be that we have emphasized too much the operative period and not paid enough attention to the postpartum course. Even after the epidemic was in full swing I felt confident from observations made in the hospital that the nurses taking



care of postpartum cases were not completely masking the nose and mouth all of the time. I tested out various masks and found that a four-ply mask of fine meshed gauze prevents organisms from being blown or sneezed or coughed through it. If a nurse is wearing a mask all day long, unquestionably she must blow her nose and take it off from time to time. Dochez found from experiments carried on in the Army that masks were not effective if worn all day. I did not stress the point, but I believe that the staff should rigidly mask not only before and during but also the first two or three days postpartum when the uterus has not yet built up its cellular resistance against the invasion of organisms. With regard to the use of vaccine in the treatment of this disease, it seems to me to be irrational, particularly in the acute stage. It would seem to be adding fuel to the flames. In vaccinating rabbits with these dead organisms to produce agglutinating serum, we found that it was difficult to get protection against even small doses of living organisms. This suggests that serum therapy would likewise be of little use."

## NEW YORK OBSTETRICAL SOCIETY

MEETING OF FEBRUARY 14, 1928

DR. W. S. SMITH reported **A Case of Pyosalpinx Caused by Oxyuris Vermicularis Complicated by Torsion of the Oviduct.** (See page 205.)

### DISCUSSION

DR. WILLIAM P. HEALY asked whether Dr. Smith had any theory as to how the worms got in.

DR. SMITH presumed that she may have had pin-worms which migrated from the anus up through the vagina, thence up through the cervix and lodged in the uterus and tubes. The process was one of very long duration on account of the density of the adhesions and that it probably caused her no trouble until the twist tightened up and gave her acute pain.

DR. RALPH A. HURD reported a case of **Successful Laparotomy for Puerperal Pyosalpinx.**

The patient was a young primipara whose pregnancy was apparently normal until about three weeks before the estimated date of confinement. At this time she began to show evidence of a toxemia which was characterized chiefly by edema of the face and extremities but also by albuminuria and a moderate elevation of blood pressure. These symptoms, mild at first, showed a distinct tendency to rapid progress for the worst, and it was decided to induce labor about at term. She was accordingly admitted to the hospital and induction attempted by the bag method which was unsuccessful. A second bagging, combined with rupture of the membranes and administration of small divided doses of pituitary extract, was performed forty-eight hours later. Labor followed but progressed very slowly with resulting extreme fatigue. After about thirty hours of difficult intermittent and relatively ineffectual labor, delivery of a living 8½-pound baby was successfully effected by medium forceps. She was examined vaginally only twice before delivery. There was a fairly deep unilateral laceration of the cervix and a median episiotomy was done, both of which were immediately repaired with interrupted catgut sutures.

On the third day postpartum the patient developed a severe chill with a rise

in temperature to nearly  $105^{\circ}$  F. It was accompanied by signs of pulmonary involvement and a diagnosis of bronchopneumonia was made. Gradual improvement in the chest took place and the temperature receded by lysis to reach nearly normal on the 13th day postpartum. The patient was in bad condition and began to complain of lower abdominal distress, which gradually became localized in the right lower quadrant and gave unmistakable evidence of an adnexal or possibly an appendix lesion. Two weeks had now elapsed since delivery and the patient was in a very serious condition. Bimanual examination revealed a tender mass to the right of the uterus. As the woman was becoming rapidly worse it was decided to remove the focus of infection.

Under gas anesthesia a posterior colpotomy was attempted but quickly abandoned because of the height and resulting inaccessibility of the lesion. The peritoneal cavity was entered through a low right rectus incision. Inspection showed normal ovaries, normal left tube, normal appendix and an apparently normal involuting uterus, although the serosa of all these organs was distinctly injected and devoid of the normal sheen of healthy peritoneum. The right tube was converted into a large spindle-shaped tumor measuring about 15 cm. in length and 5 cm. at its thickest portion. The fimbriated end was almost totally occluded but allowed the exit of minute quantities of a light creamy pus, from which was cultured the

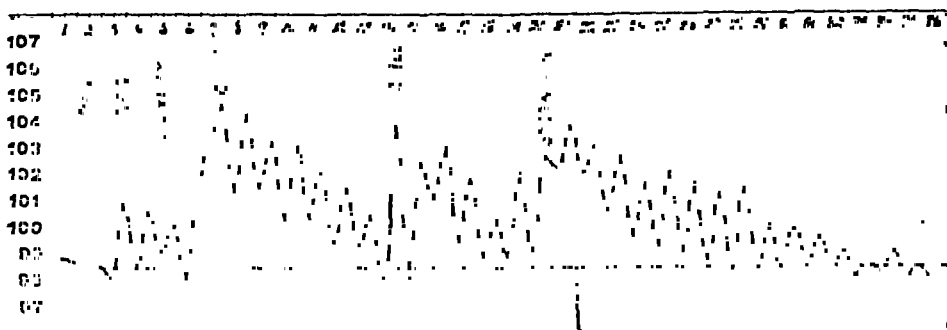


Fig. 1.

*Staphylococcus aureus*. The tube was rapidly excised and the abdomen closed after placing a cigarette drain down to the operative field and another deep into the posterior culdesac. The patient experienced a stormy postoperative period but by the fifth or sixth day began to show signs of definite improvement and continued to an uninterrupted recovery. She left the hospital with her baby after an illness of five weeks' duration and six months after confinement was in robust health with no demonstrable evidence of pelvic pathology.

It is rather surprising to find that the literature contains relatively few references to these cases, although they certainly must not be so extremely rare. Writing in 1895, Baldy relates an abdominal section for large pyosalpinx performed in 1887 one month postpartum upon a woman who was fast approaching death. He believes that this was the first time that successful laparotomy was deliberately and knowingly performed in the course of puerperal infection. He was then of the opinion that other so-called conservative methods in similar cases may well be left in the hands of the timid and that now and then abdominal section becomes not only advisable but essential.

Vineberg operated successfully by the abdominal route on several occasions. He formulated general principles to be employed in the treatment of postpartum tubo-ovarian infections and concluded that puerperal sepsis is a surgical disease and should, therefore, be treated by surgical methods. Byford published his views contemporaneously and reported four laparotomies done by himself. He felt that pus

should be evacuated through the vagina whenever possible but that one should not hesitate to perform abdominal section for the higher up and inaccessible lesions.

In 1910 Polak concluded that operative procedures should be avoided if possible and that they are not indicated unless there is demonstrable evidence of suppuration. In discussing the pathology of the various lesions of puerperal infection Williams asserts that in most instances the tubes are not involved and that when they are the lesions are secondary to the peritoneal infection.

## DISCUSSION

DR. I. C. RUBIN asked whether there was any lochimetra present, because some months ago in a woman at Mount Sinai who was five or six months pregnant, an operation was done for appendicitis. A bilateral suppurative salpingitis was discovered. Nothing was done to the tubes, the abdomen was closed, and the patient was turned over to the gynecologic service. It was a great question how that woman in the fifth month or so of pregnancy could have developed a bilateral pyosalpinx, and the nearest we came to explaining the process was that she apparently had a closure of the internal os of the cervix and lochiametra. Repeated uterine contractions, which were not only sensible to the patient, but were palpable to touch, undoubtedly expelled this purulent secretion through the patulous internal ostia of the tubes.

In the case Dr. Hurd describes, it seems in the first place, with the repeated bagging which was necessary for the toxemia and delivery, and, secondly, the suture of the cervix, that most likely a certain amount of edema in traumatized tissue probably caused a retention in the uterus, and the placenta being plastered on the one side, leaving the other side free, permitted the escape through the uterine ostium of the purulent uterine secretion, thus resulting in a unilateral pyosalpinx.

DR. WILLIAM P. HEALY was impressed by the acutely-ill condition of this patient previous to the laparotomy, and yet the limited extent of pathology that was found in the pelvis to account for this state and the promptness with which she responded to the removal of the tube. It is a very unusual pathologic finding as a complication of a puerperal infection, as practically always there is a thrombophlebitis and a much more extensive lesion of the cellulitis type, not a salpingitis and especially not unilateral.

It would seem that this must have been an infection in the tube that could only just have arisen within a few hours, practically before the operative procedure. It does not seem possible that it could have been there very many days. It did not behave like an ordinary staphylococcus infection; it behaved more like a gonorrheal infection in the fact that there was a large, free tube.

DR. HURD (closing) said in answer to Dr. Rubin's question, whether the internal os was closed and whether there was possibly a reflux of lochia into the tube on that side, that this patient seemed to have a moderate amount of lochia and the immediate suturing of the cervix did nothing to close up the canal.

DR. G. L. MOENCH presented a paper entitled **Some Points in Veterinary Practice of Interest to the Gynecologist**. (For original article see page 254.)

## DISCUSSION

DR. ROBERT T. FRANK said that Dr. Moench had drawn attention to a very important thing. That this is being more and more realized can be seen from the

fact that in the new book on biology and pathology of women by Halban and Seitz, an entire volume is given over to the study of the sex life of domestic animals.

A fact of great interest is that dealing with the lessened fertility of premature offspring. Dr. Frank referred to two sisters, fairly prominent young women, who were both premature. Their mother was a premature child, too. They are married to nonrelated husbands. One sister had two pregnancies which ended with hydrocephalic children. The other one has borne offspring which were either born dead or died in the first few days following delivery. Their family histories have been gone into by all the prominent eugenic authorities and biologists, but no light has been thrown on them. He feels inclined to think that Dr. Moench has given us a little light in this matter.

DR. DAVID MARINE (by invitation) presented an address entitled **Sex Glands, Suprarenal Interrelationship**.

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## BROOKLYN GYNECOLOGICAL SOCIETY

*STATED MEETING, NOVEMBER 4, 1927*

DR. CHARLES A. GORDON presented the report of a case of **Osteogenesis Imperfecta Congenita**. (For original article see page 214.)

### DISCUSSION

DR. ELIOT BISHOP reported a similar case in a thirty-two-year-old multipara, whose first labor was a forty-eight-hour stillbirth, in 1914. Her second, in 1916, was easy, with a normal child, now living and well. Dr. Bishop first saw her February 22, 1920. As she had profuse vaginal bleeding, a tentative diagnosis of placenta previa was made at her home, and she was packed and taken to the hospital, where, in the early morning, a vaginal examination was made, and an os admitting two fingers, but no placenta, was found.

A foot presenting was grasped and came away in his hand during very easy manipulation. Pituitrin was given and a tight binder applied, and a very fair imitation of labor ensued, and the bleeding stopped. In three hours, however, pains disappeared and bleeding began again, and a vaginal hysterotomy was done. A very friable fetus was extracted. The patient bled profusely and left the table in shock, but made a fair recovery.

An autopsy gave the following: The fetus, a female, weighed 750 grams, and was approximately 30 cm. long.

The top of the head, including the ears, was avulsed, through an oblique plane passing from the root of the nose to the suboccipital region, leaving the brain exposed and the eyes loose in their orbits. The left leg had been torn off at the knee joint and the right leg through the lower third of the femur. There was a transverse tear in the anterior abdominal wall below the left costal margin, opening the peritoneal cavity and exposing the liver.

The skin and subcutaneous tissue was everywhere edematous and like soggy, wet cardboard, but no evidence of maceration.

The fetus had a dwarfed appearance out of proportion to its apparent age, which was estimated to be seven months or thereabouts. The limbs and neck were

short, the thighs flexed and abducted. A thick layer of pale edematous subcutaneous fat covered the arms, legs, and shoulders.

The most remarkable feature was the complete absence of ossification in the calvarium, which consisted of a thin membranous layer to which the scalp was closely adherent and this membrane was lined by dura mater. There was some diffuse hemorrhage under the scalp. The latter is covered with a growth of short hair.

The bones throughout the body showed delayed and imperfect ossification. The base of the skull was composed largely of cartilage with some scattered bone deposits in the occiput and sphenoid. The vertebrae were soft and cartilaginous with small ossific foci in the bodies. The sternum contained one area of ossification in the manubrium. The shafts of the long bones contained soft dark red bone tissue. The extremities and ribs could be bent and fractured readily. The pelvic girdle was deficient in ossification. The thoracic and abdominal viscera showed no gross abnormality.

Microscopically the changes were not as striking as the gross picture. Sections made from different parts of the osseous system showed tardy ossification. The bone trabeculae were small, narrow, and fragmented. Calcification was deficient and the osteoblasts were poorly formed. There was embryonic connective tissue where bone ought to be in the process of development. Otherwise, there was nothing unusual in the microscopic pathology.

Dr. Bishop saw this patient three times that spring and she seemed to be in good condition except that once she had had a very severe attack of pelvic pain lasting half an hour. He saw her again in the spring of 1921, as her periods were very scanty and tarry in color; on the fourth visit, on May 11, she feared pregnancy, though she had had a five-day period on April 8, and there had been no coitus since March 15; her husband had developed impotence from some unknown cause. On May 19, Dr. Bishop removed her right adnexa for an ovarian cystoma with hemorrhage. Since that time she has had amenorrhea, until this July when menses reappeared.

While it must be admitted that this is in itself an interesting case, the reason for reporting the case was the consideration of the possible etiologic factors for the osteogenesis imperfecta, impotence of the male, which we know is frequently accompanied by imperfect spermatozoa; and ovarian dysfunction, as evidenced by the amenorrhea, or pituitary dysfunction, as shown by the fleeting attempt at labor.

## CHICAGO GYNECOLOGICAL SOCIETY

*STATED MEETING, DECEMBER 16, 1927*

DR. C. D. HATCH reported a case of **Hematoma in the Sheath of the Rectus Abdominis Muscle Due to Spontaneous Rupture of a Vessel.**

in the morning while turning from one side to the other in bed, she felt a stabbing pain in the upper right abdomen. It was more severe and sudden than her previous stomach attacks, and was soon followed by nausea, vomiting, sweating, and partial collapse. Physical examination made about six o'clock that morning revealed a tender, hard mass extending from the gall bladder area slightly below the umbilical line, three inches in diameter with edges well demarcated. A sedative was given and the patient was moved to the hospital.

Although this was definitely an "acute abdomen," the very sudden onset, the atypical physical signs, and the lack of corroborative laboratory findings made one hesitate about immediate surgical intervention. On entering the hospital the blood pressure was 160/92, temperature 99.6°, respiration 22, and pulse rate 80. The urine contained a trace of albumin and a few pus cells. The blood picture showed 4,000,000 red cells, 11,000 leucocytes, 75 per cent hemoglobin, and a coagulation time of one and one-half minutes. On February 6 the symptoms had abated slightly. X-ray examination on that day added nothing except a misleading suggestion that a tumor mass was pressing upon the duodenum from behind. Pelvic examination revealed only induration and resistance extending into the right lower abdomen. On February 7 ecchymosis appeared in the skin about the umbilicus and on the right abdominal wall. The temperature reached 100° and the pulse 90. Vomiting had ceased, but nausea continued. The tumor mass had increased in size, but its edges were not so easily outlined. Two tentative diagnoses were suggested: first, ovarian cyst with twisted pedicle; second, rupture of blood vessel in the abdominal wall. The possibility of the former seemed to make laparotomy imperative.

On February 8, through a right rectus incision, a handful of blood clot was removed from the abdominal wall. The peritoneum was intact and was not opened. There was no active bleeding and no fresh blood. In the bed of the cavity containing the clotted blood was the distal portion of the deep epigastric artery dissected free from all surrounding tissues for a distance of twelve centimeters. Its anastomosis with the superior epigastric could not be demonstrated and had probably been destroyed. The artery was ligated and the free portion removed. The wound was closed without drainage. The patient made a good recovery and is in good health today.

In this particular case the vessel was thrombosed, the bleeding had stopped, and the tissues would probably have absorbed the clot. If the diagnosis in this type of lesion could be definitely decided upon, it is probable that surgical interference could be avoided in those showing no evidence of continued hemorrhage.

#### DISCUSSION

DR. CAREY CULBERTSON said that since he worked up the literature on this subject in his report of two cases, he found that there are two or three cases a year reported in the German, French, English, and American literature, so that this condition while not common is not so rare and it invariably brings in the points of differential diagnosis mentioned by Dr. Hauch.

DR. IRVING S. STEIN AND DR. M. L. LEVENTHAL presented a paper on **Laparotrachelotomy: An Analytic Report of Forty Consecutive Operations Without a Death.** (See page 229.)

DR. W. C. DANFORTH AND DR. R. M. GRIER presented a paper on **Five Years' Experience With Low Cervical Cesarean Section.** (See page 239.)

## DISCUSSION

DR. J. B. DELEE said he was pleased that the various hospitals and most of the members were recognizing the value of the low or cervical cesarean section, to which he has given the name of laparotracheotomy.

On theoretical grounds Dr. DeLee has the following objections to the transverse incision: In the first place, the danger of hemorrhage, which Dr. Stein says is minimal. He has had 5 cases, in 2 of which the hemorrhage was considerable from the base of the broad ligament. These operations were performed by experienced men. A surgeon in another hospital had a case of severe hemorrhage, requiring transfusion. Difficulties might arise in the subsequent labors. Physiologically, when the uterus contracts, it pulls away from the cervix in a longitudinal direction. There is a predisposition to abdominal hernia, admittedly greater with the vertical incision. The next objection is that in case an infection occurs, the pus is high up in the abdomen rather than low down near the external os where it can be readily reached, or easily find exit. When a woman with a low cervical section becomes infected, it is not at all difficult to put the finger through the external os and force it through the stitches under the bladder and let out the pus. Furthermore, the pus very often takes its way out through that opening, whereas if the pus were high up under the bladder it would be more apt to cause a perimetritis or a thrombophlebitis. Another objection is that anatomically the blood vessels in the midline are smaller and less numerous. A practical objection that he found was the difficulty of making an accurate suture. The upper end of the lower segment is more likely to retract into the body of the uterus, particularly if the woman has been in labor long. The only case of embolism he had in his large series of low cervical sections was in a transverse incision. That patient recovered. The only advantage he could see in a transverse incision is that it is a little bit simpler and the delivery is a little easier.

Although experiments show that ethylene does not increase the clotting time of the blood nor the coagulation time, Dr. DeLee found that the amount of hemorrhage is often greater than it should be. However, ethylene is becoming more pure and perhaps the tendency to oozing is being eliminated. He uses it a great deal but had many cases in which he is convinced that ethylene caused extra bleeding.

At the Lying-in Hospital they give what is called "dosilene," a little alcohol, a few drops of ether and water, purely suggestive. No general anesthetic is used, if local anesthesia is possible, and he cannot recommend this plan too highly.

The low cervical cesarean section is considered more difficult than the classic. On the other hand, he has had quite a number of classic sections that caused a great deal of concern. Some of them bleed frightfully. Several times he has had to pack. There have been quite a number of cases of death from hemorrhage after the classic. The uterus relaxes or ruptures itself and the woman bleeds. Most of the cases of postoperative shock after classic cesarean section are due to that fact. There is not a case on record where a woman has bled after the cervical cesarean section. Once in a while a low cervical presents complications. If the man starting the practice of cervical cesarean section will limit his operation to the woman who has been in labor a long time, he will have no difficulty. The test of labor is a very uncertain matter. Some men will call a test of labor a few hours. Others will wait until the cervix is dilated and the pains are very strong for several hours. Sometimes a woman is considered to have had a sufficient test of labor when she starts out manifestly wrong; again he waits a long time. He cited a case in point: A woman pregnant for the second time was brought to the hospital. She had a high forceps with her first baby and had a justo minor pelvis. He thought he could get the seven pound baby through. A test of labor was given. She began having pains at 12 o'clock one day and labored until the next afternoon at 5. She had good pains and complete dilatation. He ruptured

the membranes and let her labor for two hours with very strong pains recurring every two minutes. At the end of that time the head was just as high. He then did a cervical cesarean under local anesthesia. She is now making a perfect recovery.

He has adopted the interrupted suture almost entirely for the low cervical. It takes fifteen to twenty minutes longer but seems to be better.

DR. CARL HENRY DAVIS said that during the past year some interesting anesthetic experiments had been done by Dr. Yates and Dr. Raine at Columbia Hospital, Milwaukee. They demonstrated that thirty minutes of anesthesia with ethylene oxygen or nitrous oxide oxygen, without an operation reduced the oxygen-carrying power of the blood to such a degree that it would take a transfusion of 500 c.c. of blood to bring it back to normal. After surgical operations it was found that it would be several days before the oxygen-carrying power was back to normal. He thought this was one of the strongest arguments ever advanced for local anesthesia.

Dr. Davis questioned whether or not it is advisable to do a cervical type operation in patients who have been delivered previously by the classic operation.

DR. D. A. HORNER called attention to a complication that occurred in two cases in which no packing was used. In both lochiometra developed which gave the patients considerable trouble. In no case that he knew of in which packing was used in the cervix has lochiometra developed because packing itself has a tendency to contract the uterus and if the cervix is not well dilated, it will have a tendency to increase the dilatation.

Infection is not produced, as a rule, by the introduction of the packing which is a prophylactic. There are several cases reported in which the packing was included in the suturing. In these cases difficulty was encountered in removing the packing. In one instance the packing was left in the uterus and was finally removed after the patient had been sent home several weeks after operation. No complications developed while she was at home, even though she removed the packing herself.

DR. J. P. GREENHILL said there were records of only eleven authentic cases of rupture of the lower uterine segment scar after the low cervical section in a series of over 25,000 cases. All of these ruptures occurred during labor—none during pregnancy.

At the Chicago Lying-in Hospital a follow-up in patients who have had more than one cervical cesarean section is being done. Thus far they have had 87 repeated cervical sections. Most of these were second operations but 8 patients have had a third and 1 patient a fourth cervical operation. There has not been a single case of rupture of the uterus. There have been 2 maternal deaths. An interesting point is that a number of these patients subsequently became pregnant and were delivered through the natural passages either spontaneously or by forceps.

Dr. Greenhill is now studying the scars removed at the second, third, and fourth low cervical operation. In nearly all cases the scar is not visible to the naked eye, but pieces of tissue excised from the area believed to be the site of the previous incision or incisions showed evidence of scar tissue microscopically in most instances. The scars were strong in practically all the cases. In 2 cases microscopic examination of the scars showed definite evidence of inflammation.

Not only can low cervical cesarean sections be performed successfully under local anesthesia but also Porro operations.

DR. C. S. BACON said that the papers read did not quite settle the doubts in his mind regarding the advisability of the low cervical cesarean section. In the first place, the indications for the operation were necessarily given rather briefly



and therefore perhaps not satisfactorily. The test of labor is so uncertain and unscientific that he did not think it counted very much. Then the comparison of the results of the low cervical section done by very competent experts with the results of cesarean section done by individuals in all parts of the country is not quite fair. It seemed to him that the decision is chiefly dependent on what Dr. DeLee spoke of, namely, the nature of the scar after low section. If the scar is better and stronger in low section, then that may be a very good reason for making it. It is a more difficult operation than the classic operation; it takes longer, and it is attended with a great deal more danger for the average operator. As far as infection is concerned, it is doubtful whether there is very much advantage in it.

DR. M. L. LEVENTHAL said that some of the patients reported in Dr. Stein's series are pregnant for the second time and they have had an opportunity to test the scar in those cases. In one case a patient delivered by a low cervical section with longitudinal scar came up for appendectomy one year later. The line of incision was examined, no evidence of any scar was found and there were no adhesions. In the other case the patient had a low cervical section a few years ago and was recently delivered vaginally, having been in labor fourteen hours. Upon removal of the adherent placenta, the lower segment was examined and no evidence of scar was found.

In this whole series no bladder injuries occurred even though the bladder was high during operation; and no more catheterizations were necessary than after pelvic delivery.

DR. J. L. BAER said that an analysis of the Lying-in Hospital statistics, presented by Dr. DeLee, gave a mortality rate of 1.1 per cent in low cervical cesarean section. An analysis of the Michael Reese Maternity in the two groups, classic section and low cervical section, all done by members of the obstetric staff of the hospital, trained obstetric surgeons, reveals that in the classical section there was a mortality of 5.5 per cent and in the low cervical 1.3 per cent, which to him was very conclusive evidence of the advantage of the low type of section. In this connection he took occasion to answer the comment published by Dr. DeLee in the *Year Book* of 1925, relative to the increased risks for confinement cases in the general hospital, of which Michael Reese represents one. The morbidity presented by Dr. Stein and the mortality of 1.3 per cent in the low cervical section as against 1.1 per cent for the Lying-in Hospital indicate that a maternity ward properly conducted in a general hospital compares favorably in mortality and morbidity with the maternity hospitals.

In connection with the disadvantages of the transverse incision that Dr. DeLee brought up, Dr. Baer stated that Munro Kerr does not use pituitrin. He maintains that by avoiding pituitrin he has a normally retracted upper half of the lower uterine segment and he, therefore, has no difficulty in suturing the transverse incision, the cut edges remaining equally thick.

Also on the question of rupture, they are using the transverse incision and for the past year have shaped the incision decidedly more semilunar than transverse with convexity pointing downward, so there is no risk of extensive lateral tearing. The scar is reinforced against vertical pull by the upturned ends and the flap affords even easier access for the head.

DR. DANFORTH, in closing, said he was very thoroughly convinced after what he considers to be an adequate test of both types of operation that the low cervical is the better of the two, not only for a test of labor but also as an elective operation.

He agreed with Dr. DeLee that sometimes in dealing with the classic section the hemorrhage was difficult to manage. While he sometimes has hemorrhage in the low cervical that is troublesome, he has had no trouble in controlling it.

Dr. Danforth's first series represented 30 cases and since it was made up, 2 more cases occurred, making a total of 32, the same as Dr. Stein's series, so that the two papers presented represent a total of 64 cases. The time of rupture of the membranes is a little longer in Dr. Stein's series—17 against 12. There has been no essential difference in the recovery, in this type of operation and the old type, but there is considerable difference in the mortality. The mortality for the classical operation is around 7 per cent. The deaths are not entirely due to the operation. One patient had a cardiac dilatation; the autopsy showed no trouble in the abdomen. One patient died from pulmonary embolism. There were no deaths from sepsis.

He did not think that there was an attempt in this presentation to make a comparison of the results of cases done by men who are supposed to be experts in this field and the general operator. Dr. Bacon spoke of the lack of value of such comparison. That is not peculiar to cesarean section because the mortality in any operation is less in expert hands. Even in well run hospitals, such as Michael Reese or the Evanston, the mortality from the old operation does run higher than in the low operation. From that point of view as well as the point of view of morbidity he believed the low operation has the advantage over the old operation.

So far he has not done a second cervical section on a woman who has already had one. In answer to the question whether a woman who had had a classic section should not be delivered the second time by a classic section, he said that was a matter that had to be decided at the time. If the classic section scar was good and there were no adhesions below to give one trouble, he saw no reason why one should not do the second section by the cervical method.

# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Selected Abstracts

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### Physiology and Pathology of the Breast

Pianese, F.: Researches Concerning the Origin of the Epidermal Pigment of the Nipple and Its Areola. *Archivio di Ostetricia e Ginecologia*, 1925, xii, 73.

The majority of investigators believe the epidermal pigment is of dermal origin and is elaborated by the endothelial reticulum. Others assume that the pigment is of epidermal origin. There finally is a mixed theory, i.e., the pigment is sometimes of dermal and at other times of autochthonous origin.

In his researches, Pianese has been able to show that the pigment is distributed in the epithelial cells in the form of very small granules attached to the small threads of the protoplasmic network of the cells. This position of the pigment granules shows that the pigment is of protoplasmic origin and is either a transformation or a secretion, and that it originates in the epithelial cells.

In pregnancy the extension and increase of the pigment depend upon the peculiarities of general pigmentation in the individual.

E. L. FAUST.

Horn, J.: *Hypermastia Axillaris*. *Acta Gynecologica Scandinavica*, 1924, iii, Supplement.

Hypermastia signifies abnormally situated breast tissue. According to Horn, this condition is found in 3.5 per cent of Norwegian women and occurs three times as frequently as all other forms of ectopic breast tissue. In 13.5 per cent of the cases where hypermastia axillaris occurs, it is associated with breast tissue situated in other abnormal locations. The axillary type is distinguished from the other types by the very rare occurrence of nipples, areolas, or areolar musculature. In only 2 per cent of the cases is a rudiment of a nipple found. In structure, the axillary breasts resemble exactly that of the normal breast, but they are smaller and usually have no nipples. Axillary breasts undergo the same hypertrophy during pregnancy and the same regressive changes in the puerperium and like true breasts they can develop markedly at puberty and during the menstrual periods. At puberty and during menstruation and pregnancy they seldom produce symptoms but post-partum they are often painful. They have very little clinical significance.

J. P. GREENHILL.

Purvess and Hadley: *Accessory Breasts in Labia Majora*. *British Journal of Surgery*, 1927, xv, 279.

parative anatomic point of view. The breasts were removed and proved, histologically, to be made up of actively lactating mammary gland tissue.

M. SEELIG.

Dyroff, R.: *The Physiology of Mammary Gland Secretion*. Archiv fuer Gynäkologie, 1926, cxxix, 308.

The author determined the differences existing under the various conditions of pregnancy, puerperium, menopause, etc., between the intramammary temperature and the temperature of the blood. A small incision was made in the skin of the breast and a fine capillary thermometer inserted directly into the breast tissue. He found that the temperature within the breast increased as lactation becomes established. The difference between blood temperature and the intramammary temperature, exclusive of pregnancy and lactation, is  $1.64^{\circ}$ . There is a temperature rise in the breast when the milk comes in and the breast may have two degrees more temperature during this time than the blood shows. A failure to show this rise in breast tissue temperature may be of help in the differential diagnosis of hypogalactia. There is no direct relationship between the amount of breast secretion and the congestion and swelling of the breasts at the onset of lactation. There is no intramammary rise of temperature during nursing. There is, however, a marked temperature rise in the breast during the first ten to fifteen minutes following lactation which gradually recedes as the breasts refill. During the first half of pregnancy there is a slight difference in temperature between blood and breast ( $0.6^{\circ}$ - $0.9^{\circ}$ ). The figures approximate those found in the nonpregnant state. In late pregnancy there is practically no difference. The same holds true for the breast in abortion. Extrauterine pregnancy when unruptured shows the same differences as are found in early pregnancy and when ruptured resemble those found in abortion. Menstruation, tumors and adnexal disease produce no temperature changes in the breasts.

RALPH A. REIS.

Nakanishi, Y.: *The Temperature of the Breast in Pregnancy and the Puerperium*. The Japanese Journal of Obstetrics and Gynecology, 1927, x, 43.

It is a physiologic fact that glands in general show a rise in temperature during secretory function. The mammary glands exhibit the same rise in temperature. The following is a summary of observations made in 444 nongravid, gravid, and puerperal women.

The breast temperature of healthy nongravid women is far lower than that of the axilla. The breast temperature of gravid women is higher than that of the axilla.

No difference is recognized between primigravida and multipara with regard to the temperature of the breast which does not secrete colostrum. It rises as the pregnancy advances and in the puerperium it is higher than during pregnancy. It is higher immediately after lactation than before nursing, and in puerperal women who do not nurse it is absolutely the same as, or lower, than that of the axilla on the fifth to seventh days after labor. In puerperal women who have insufficient secretion it is often lower than that of the axilla. When improved by treatment, it is higher than that of the axilla.

The measurement of the temperature of the breast is a convenient way for determining the prognosis as to the secretion of the milk.

J. P. GREENHILL.

**Polano:** Investigation of Cyclic Changes in the Female Breast During the Period of Sexual Activity. *Zeitschrift für Geburtshülfe und Gynäkologie*, 1924, lxxxvii, 363.

The glandular tissue of the female breast, both in nulliparous and in parous patients, shows physiologically a cyclic proliferation in the premenstrual stage, which is followed at the beginning of menstruation and during the interval by a retrogressive phase. In contrast to the uterine mucosa, however, there are such great individual variations in the degree of proliferation and particularly in that of retrogression that the establishment of typical normal pictures, especially of the interval stage, is extremely difficult.

MARGARET SCHULZE.

**Tso, Ernest:** A Study of the Fat Lactose, and Protein Content of Chinese Women's Milk. *The China Medical Journal*, 1924, xxxviii, 626.

A study of 87 samples of Chinese women's milk shows that its percentage composition differs in no essential respects from the composition of human milk in other countries. The fat content varies considerably in individual samples. It is generally high in the strippings and low in the fore milk. It tends to be higher in mature and late milk than in colostrum milk. Samples obtained practically simultaneously from the right and left breasts may at times be quite unlike in their fat percentage. An investigation of the milk of those women who nurse their own babies and the milk of wet nurses shows that the former is usually richer in fat content than the latter.

The lactose is, relatively speaking, the most constant. The protein content varies to a wider extent than does lactose, and less so than fat.

F. J. SOUBA.

**Grant, Agnes H.:** The Nutritional Requirements of Nursing Mothers. The Effect of Lowering Both the Antirachitic Vitamine and Calcium in the Diet of the Mother Upon the Development of Rickets in the Young. *American Journal of Hygiene*, 1926, vi, 228.

The effects of lowering both the antirachitic vitamine and calcium of the mother's diet are seen in the retarded growth of the young when they are kept on a uniform low calcium, low vitamine diet, as well as in the change in the type of rickets which develops on this diet, and in the increasing readiness with which the disease attacks the spine.

The rate of growth of the young, after weaning, is correlated with their weight when they are weaned, and upon the length of the interval before they begin to develop signs of rickets. The weight curves flatten as the disease develops, until finally all growth ceases, and the weight curves become straight lines.

The age at which the young begin to develop signs of rickets, the rapidity with which the disease develops, and the severity of the final lesions depends more upon the diet of the mothers than upon the weight of the young when they are weaned; the largest and most resistant of the young from mothers on rachitic diets develop rickets at an earlier age, and in a more severe form, than the lightest weight young from mothers on a complete diet.

The type of rickets which develops in young that are kept on a uniform low calcium, low vitamine diet changes from the slow progress of the chronic type of this disease to the rapid development of the very acute types, as the vitamine and calcium content of the mothers' diets are progressively altered from the diets which are rich in both calcium and vitamine to those which are deficient in both of these factors.

The increasing readiness with which rickets attacks the spine in the young that are kept on the uniform rickets-producing diet is a fairly accurate index of the kind and amount of the calcium and vitamine deficiency in the mother's diet.

ADAIR AND PROSHK.

Stockman, Ralph: *The Action of Atropine on Milk Secretion.* Edinburgh Medical Journal, 1927, xxxiv, 340.

It is ordinarily taught that preparations of belladonna suitably made up for direct application to the mamma are clinically very effective in arresting the secretion of milk.

As it is often necessary in practice to arrest milk secretion in women owing to intercurrent illness or for other reasons, it seemed desirable to settle the question definitely from the practitioner's point of view, and this could readily be done in a midwifery clinic. Fifty-two cases were treated, and the same procedure was followed in them all, 1/100 grain atropine sulphate being administered hypodermically morning and evening for the first seven days after delivery. No other treatment was given except in a few of the cases noted below.

Seventeen of the 52 were primiparae, all healthy young women with abundance of milk. In 15 of these the amount of milk formed after beginning the atropine was so small that it caused no discomfort and no further treatment was required; in one, the breasts became hard on the third day and a single dose of magnesium sulphate was given in addition; one began to nurse her child but it died on the second day. The breasts became hard on the fourth day of atropine administration, and a dose of magnesium sulphate was given after which no milk formed.

Thirty-five were multiparae, all of whom had a plentiful supply of milk, but nursing was avoided on account of debility, anemia, tuberculosis, nephritis, or death of the child. In 27 of these the secretion of milk was completely arrested; in 7 sufficient milk formed to cause discomfort and to require the administration of one or several doses of magnesium sulphate; in one an acute attack of pyelitis with high temperature supervened on the seventh day. Nursing was stopped and atropine given, but it failed to arrest milk secretion and the breasts had to be exhausted.

Our knowledge of the physiology of milk secretion and its relationship with the nervous system and certain of the endocrine glands is so unsatisfactory that it would be waste of time to indulge in what must be mere speculation regarding the mode and point of action of atropine in arresting it, but it seems certain that the commonly accepted view that atropine has the power to arrest milk secretion is correct.

WM. C. HENSKE.

Debuys: *A Simple Dressing for the Breasts of Mothers of the Newly Born.* American Journal of Diseases of Children, 1927, xxxiii, 841.

The author devised an adhesive plaster dressing (shown in photographs) which holds the breasts perpendicular to the chest wall and pointing directly towards front. They are supported in this position without being pressed down. There is no compression of the mammary glands, no obstruction to any of the ducts and no twisting of the nipples; hence the milk may be secreted without obstruction, and the natural leakage of the excess milk may take place in a normal way. It is most useful when applied about the fifth day and allowed to remain for about five days.

Fissured nipples, and caked or abscessed breasts have been rare with the use of this dressing.

S. E. PESETKE.

Irvin, Robert, R.: Caffeine in the Breast Milk of Coffee and Tea Drinkers. *Medical Journal and Record*, 1926, cxxiv, 37.

There was obtained constantly from the breast milk of coffee and tea drinking mothers a substance possessing the characteristics of caffeine. In crystalline shape, solubility in water and chloroform, and in its capacity to be sublimed, this substance is highly suggestive of caffeine, or possibly a derivative thereof. Since it was found only in traces in human milk its absolute identification was extremely difficult.

The caffeine-like crystals were found to be absent in the breast milk of a woman who drank no coffee, tea, or other alkaloid containing substances.

WM. C. HENSKE.

Frensdorf: Transmission of Luminal Through Milk. *Münchener Medizinische Wochenschrift*, 1926, lxxiii, 322.

It has been previously shown that such substances as iodine, salicylic acid, ether, mercury, salvarsan, and morphine when administered to the pregnant or nursing mother could be recovered in the mother's milk. The author reports a case of a patient, forty-six years of age, who in the ninth month of pregnancy, was seized with an epileptic fit. The patient was given 0.3 gm. of luminal in 3 doses in one day. There was no repetition of epileptic seizures. One week after the attack the patient was delivered of a normal apparently healthy female infant which cried lustily at birth. The infant was put to the breast at 3-hour intervals but after the second day it refused to nurse. The infant seemed to be in a state of "twilight sleep" for six days. This was suggestive of a cumulative effect of the luminal excretion. From the eighth day to the eleventh day on discharge the baby was again perfectly normal. By this time the luminal must have been completely excreted when the baby resumed its normal state.

As yet there is no literature as regards this drug with special reference to its excretion in breast milk.

W. B. SERBIN.

Schreiner: Shall the Child Nurse in the Presence of Mastitis? *Zentralblatt für Gynäkologie*, 1924, xlviii, 1015.

The question of treatment of the mastitis of nursing women, particularly whether at the beginning or during a mastitis the child should be nursed, is discussed by Schreiner on the basis of 151 cases of mastitis observed among 5,252 patients in Cassel. He concludes that at the first clinical appearance of mastitis nursing should be interrupted, and the breast placed absolutely at rest and treated with antiphlogistics. This gives satisfactory results in 90 per cent of cases, and the temporary removal of the child until the disappearance of inflammation is followed by permanent loss of secretion in only a very small percentage of cases.

LITTLE.

Schmidt: The Treatment of Commencing Mastitis With Local Injection of the Patient's Blood. *Zentralblatt für Gynäkologie*, 1925, xlix, 1893.

The writer adds to the accepted methods of treatment of early mastitis the injection of patient's blood to which has been added 3.8 per cent isotonic sodium citrate solution. The injection is made around and underneath the infiltrated area, 20 to 50 ccm., according to the extent of the breast involvement. In five cases there was a rapid decrease in the size of this area, and healing without abscess formation, so that the mother was able to nurse in four or five days. The sixth

case was cured after two series of injections, but in a further five cases where only a small quantity of blood (10 c.cm.) was injected, incision and drainage unfortunately were necessary.

LITTLE.

Seitz, L.: The Treatment of Mastitis by Means of the Bardenheuer Incision. *Monatschrift für Geburtshilfe und Gynäkologie*, 1925, lxxi, 134.

The author recommends the use of the Bardenheuer incision for recurring mastitis with multiple abscesses, for deep-seated and retromammary abscesses and for diffuse phlegmonous inflammation over a great part of the breast. The incision is made as follows: An arc-shaped incision is made at the lower edge of the breast, thereby separating the gland tissue from the underlying tissue. The breast is lifted up, all abscesses are opened and gauze is inserted into the wound. Because of the position of the incision there is abundant drainage when the patient is in the horizontal position. When the scar heals it is entirely concealed by the overhanging breast. This incision was used by the author with success in seven cases.

J. P. GREENHILL.

Harttung: The Treatment of Mastitis With the Patient's Own Blood, the Bardenheuer Incision and Secondary Suture. *Monatschrift für Geburtshilfe und Gynäkologie*, 1927, lxxvi, 4.

In the early treatment of mastitis the author warmly recommends the intramuscular injection of the patient's own blood. The beneficial results are the same as those derived from protein therapy. Where incision of the breast is necessary, the type of incision which gives the best results in all cases is that of Bardenheuer at the lower edge of the breast. The after-treatment consists of the application of tampons saturated with 10 per cent sodium chloride solution. On top of these, compresses of normal salt solution are placed. The hypertonic saline solution must be made to saturate the entire wound. After the wound is clean, the edges are sutured without disturbing the granulation tissue.

J. P. GREENHILL.

Hartmann, Renaud, and d'Allaines: Pseudo-Neoplastic Tuberculosis of the Breast. *Gynécologie et Obstétrique*, 1924, x, 6.

Most writers have concerned themselves with consideration of disseminated or confluent forms of breast tuberculosis. There is another type which does not at all resemble tuberculosis to the naked eye and reveals its true character only on microscopic examination. The authors have had three cases of this form, called pseudo-neoplastic tuberculosis.

Case I., forty-nine years old, complained of a tumor of the breast. The first symptom noticed was a retraction of the nipple, later a very slow increase in volume of the indurated area, never particularly painful. Amputation of the breast with removal of the subjacent portion of the pectoralis major; axilla dissected. Patient made an uneventful recovery.

Pathology: On cut section of the tumor one sees a very voluminous mass of fibro-fatty material which is separate from the nipple. Immediately below the nipple there is a reddened area in the center of which is a small cavity containing greenish liquid. Microscopically there are glandular lobules filled with characteristic inflammatory lesions in the middle of which one finds occasionally typical follicular lesions of tuberculosis.

Two other similar cases are cited, in each of which operation was done for supposed carcinoma of the breast.



The authors stress the fact that the important picture microscopically is a diffuse inflammation of the breast, the lesions being in the *connective-tissue layer*. The gland itself seems little affected. Occasionally a proliferation of the acini occurs, giving the picture of adenomas.

This illness develops, in general, in healthy subjects. Rarely is any pulmonary tuberculosis demonstrable. The onset is insidious, with little or no pain. The tumor simply appears. Age incidence on twelve collected cases was thirty-five to sixty, thus corresponding with cancer. This form constitutes approximately 35 per cent of breast tuberculosis.

The most confusing thing about this type to the surgeon is that it almost invariably is adherent to the skin, which often takes on the appearance of an orange skin and is accompanied by retraction of the nipple. Axillary adenopathy is habitual but not particularly characteristic. The evolution is slow, simulating cancer. In one case there was a bloody discharge from the nipple and it was thought to be an intracanalicular epithelioma.

In the caseous forms or frankly suppurative forms cures can sometimes be effected by simple incision, followed by drainage with curative injections or curettages, but usually recourse is taken to amputation. In the pseudo-neoplastic form, amputation with axillary dissection seems the sole treatment which has been practiced up to date. The procedure is thus the same as for carcinoma, but it seems useless to make excisions of muscles and the operation ought to be more limited.

ADAIR AND PIERCE.

## Books Received

**GYNECOLOGY.** By William P. Graves, Professor of Gynecology, Harvard Medical School. With 562 illustrations, 128 in colors. W. B. Saunders Company, Philadelphia, 1928.

**HANDBUCH DER INNEREN SEKRETION.** Herausgegeben von Dr. Max Hirsch. Verlag von Kurt Kabitzsch. Leipzig. Lieferungen 4, 5 und 6.

**OBSTETRICAL NURSING.** By Carolyn Conant van Blarcom, R.N. Second edition, revised. With 216 illustrations and 10 charts. The Macmillan Company, New York, 1928.

**HORMONE UND INNERE SEKRETION.** Von Privatdozent Dr. Fritz Laquer. Verlag von Theodor Steinkopff. Dresden. 1928.

**STERILITY IN WOMEN.** Diagnosis and treatment. By Sidney Forsdike, M.D., B.S. (London), surgeon to the hospital for women, Soho Square, London, etc., etc. With 24 illustrations including 17 plates. H. K. Lewis & Co., Ltd., London, 1928.

**L'EXPLORATION RADIOLOGIQUE EN GYNÉCOLOGIE.** Par Paul Bédère, professeur agrégé à la faculté de médecine de Paris. Masson et Cie, éditeurs. Paris, 1928.

**INTERNATIONAL CLINICS.** Volume II, 38th Series, 1928. J. B. Lippincott Company, Philadelphia, 1928.

**SALPINGITIS ISTHICA NODOSA.** Von Dr. Franz Horalek, Brunn. Verlag von F. Topik. Prag, 1928.

**BIOLOGIE UND PATHOLOGIE DES WEIBES.** Herausgegeben von Hahn und Seitz. Urban und Schwarzenberg, Wien, 1928. Lieferung 43.

**FOLKLORE OF THE TEETH.** By Leo Kenner, Yankton State Hospital, South Dakota. The Macmillan Company, New York, 1928.

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## Original Communications

### A SURVEY OF CESAREAN SECTION IN THE BOROUGH OF BROOKLYN, CITY OF NEW YORK\*

BY CHARLES A. GORDON, M.D., F.A.C.S., BROOKLYN, N. Y.

IN 1926, the Brooklyn Gynecological Society decided to undertake an investigation into the indications for which cesarean section was being done in the Borough of Brooklyn, City of New York.

On the Survey Committee were Drs. Ralph M. Beach, Francis B. Doyle, Harvey B. Matthews, George W. Phelan, Joshua Ronsheim and Charles A. Gordon, Chairman. The results of that study have been analyzed by the Chairman.

Our inquiry was modeled on "The Results of a Collective Investigation into Cesarean Section performed in Great Britain and Ireland from the year 1911 to 1920 inclusive," analyzed by Eardley Holland, in the *Journal of Obstetrics and Gynecology of the British Empire* (Autumn-Winter, 1921).

Professor Holland gave us much help at the beginning of our work and sent us copies of his forms which we have closely followed. Our material, too, is arranged like his, both because we thought his work exceedingly well done, and because paralleling his study would make the details of our analysis more accessible.

Cesarean section has been studied in the hospitals of the Borough of Brooklyn, City of New York, for the years 1921 to 1926 inclusive. All the hospitals in Brooklyn where we believed cesarean section was being done were invited to participate. Blank forms were arranged for convenient tabulation. All the large hospitals and many of the small ones furnished their statistics and cooperation was excellent.

Not all the cesarean sections done in Brooklyn during this period were available for study, as a few of the small private hospitals were

\*Presented at a meeting of the Brooklyn Gynecological Society, 1928.

unable to supply us with their figures. A specimen sheet and sets of four blanks with space for detailed information were provided. (1) Cases of Contracted Pelvis. (2) Cases of Eclampsia and Other Toxemias of Pregnancy. (3) Cases of Antepartum Hemorrhage (placenta previa and accidental hemorrhage), and (4) Other Conditions. Headings, questions and details were of course the same in every case, and special columns were provided to show the number of hours in labor, whether membranes were ruptured or not, and the number of vaginal examinations made.

The following request accompanied the tables: "Under the heading Condition of patient at time of operation, please state: (1) If patient was in labor or not; (2) How long in labor before operation; (3) Stage of labor; (4) Membranes ruptured or not; (5) Number of vaginal examinations; (6) If forceps delivery or version had been attempted."

TABLE I

	I CONTRACTED PELVIS	II ECLAMPSIA AND OTHER TOXEMIAS OF PREGNANCY	III ANTE- PARTUM HEMORRHAGE	IV CONDITIONS OTHER THAN 1, 2 AND 3
Methodist Episcopal	181	40	15	122
Long Island College	89	25	10	89
Jewish	153	7	4	28
Carson C. Peck Memorial	28	9	4	77
Brooklyn	27	11	5	56
St. Catherine's	52	5	9	3
Norwegian	31	19	5	13
King's County	43	4	4	4
Prospect Heights	31	12	5	7
Bedford Maternity	34	—	8	10
St. John's	22	15	3	9
St. Mary's	8	8	6	22
Brownsville and East New York	24	4	5	8
Samaritan	13	8	2	17
United Israel-Zion	26	3	1	8
Beth Moses	24	2	2	10
Wyckoff Heights	6	6	11	11
Bushwick	17	4	1	10
Greenpoint	21	2	3	3
Midwood	11	4	4	7
Dr. Wade's	15	3	—	5
Cumberland	12	7	—	3
Calendonian	8	2	3	5
Holy Family	7	1	—	5
Bethany Deaconesses	8	2	—	3
Unity	12	—	—	—
Bay Ridge Sanitarium	7	—	1	2
Williamsburg Maternity	6	1	2	—
Brooklyn Hebrew Maternity	6	—	1	1
Coney Island	5	2	1	—
Swedish	6	—	1	1
Riverdale	1	1	—	5
Lutheran	—	1	1	—
Mt. Sinai	—	2	—	—
	921	216	117	544

"Under Eclampsia please state: (1) How many convulsions before operation; (2) The amount of albumin in urine at time of operation and on discharge; (3) Time between first convulsion and operation; (4) How many convulsions followed operation and when they ceased."

"Under Placenta Previa, please state, Variety, i.e., central or covering os uteri only partially."

In all, the details of 1805 cases were returned to the committee. These cases have been analyzed as fully as the recorded details would permit.

Table I gives a list of the hospitals which returned the forms, with the number of cases in each class.

### I. CONTRACTED PELVIS

*Maternal Mortality.*—The number of cases in which cesarean section was performed for pelvic contraction is 934 with a maternal mortality of 54, or 5.8 per cent. Not all the cases of contracted pelvis are included in this group, but only those in which pelvic contraction was given as the indication for operation. Other cases will be found in Group 2, and in Group 4, under the heading of "Previous Sections."

In this group of 934 cases there were 244 women who had been sectioned before; as follows:

One previous section,	202 cases
Two previous sections,	33 "
Three previous sections,	8 "
Four previous sections,	1 "

In 63 cases the duration of labor was not stated, but the remaining 871 may be divided into the following important groups in which the maternal mortality is subdivided:

	TOTAL CASES	DEATHS	PER CENT
A. Not in labor	343	12	3.5
B. Early in labor	110	7	6.4
C. Late in labor	*403	31	7.7
D. After induction of labor	1	0	—
E. After attempts at delivery	14	2	13.6

Classes A, D and E are as stated. Class B includes cases very early in labor, indicated as "just began," "short time," or "at onset," and all cases in which labor had lasted six hours or less. Class C includes all cases late in labor from six hours to days, and cases stated to have had a "prolonged test."

There were 6 cases of cesarean hysterectomy, with no deaths. The indications for hysterectomy were as follows:

Case 1. Double mitral disease, flat pelvis. Three vaginal examinations.

Case 2. In labor 40 hours with a temperature of 103 before operation.

\*Includes 6 cases of cesarean hysterectomy.

- Case 3. In labor 48 hours, membranes ruptured 36 hours, repeated vaginal examinations by midwife and doctor.
- Case 4. In labor 17 hours, membranes ruptured 17 hours, two vaginal examinations.
- Case 5. In labor 72 hours, membranes ruptured 36 hours, repeated vaginal examinations and an attempt at forceps delivery.
- Case 6. In labor 40 hours, membranes ruptured 20 hours, six vaginal examinations.

Deduction of these cases would slightly reduce the maternal mortality for the contracted pelvis group.

The cause of death is stated in 51 of the 54 fatal cases:

Peritonitis	17
Septicemia	9
Hemorrhage	4
Pneumonia	4
Persistent vomiting	1
Shock	3
Embolism	5
Empyema	1
Pulmonary edema	2
Acute cardiac dilatation	2
Acute gastric dilatation	3

*Fetal and Infant Mortality.*—Among the 934 operations for contracted pelvis were 6 cases of twin pregnancies, and 4 cases in which the condition of the child was not mentioned, 936 babies in all. Of these, 900 left the hospital alive, 18 were stillborn, and 18 died later in hospital. The fetal mortality then is 1.9 per cent and the total mortality for the baby in this group is 3.8 per cent.

Further analysis of the stillbirths showed 5 cases not in labor, 10 in labor from twenty-six to seventy-two hours, while in the 3 cases the duration of labor was not recorded. One fetus had hydrocephalus.

Eighteen babies died during their hospital stay. Of six babies whose mothers were not in labor, one died of gastroenteritis on the fourteenth day, one of patent foramen ovale three weeks later, three died of pneumonia on the fourteenth and fifteenth days and one of pyloric stenosis. Three died in cases where forceps had been attempted. In three cases there was no statement as to the length of the labor, and in 6 cases labor had lasted from six hours to ninety-six hours.

The following operations were performed in these 934 cases:

Classical	723
Classical and myomectomy	4
Classical and sterilization	57
Classical, sterilization and salpingectomy	2
Lower segment operation, sterilization	1
Lower segment operation	138
Cesarean hysterectomy	6
Not stated	3

Among the classical operations, 3 are stated to have had the parietal peritoneum sutured to the uterine peritoneum about one inch away

from the uterine incision; another case is described as "high, classical, two flap." The lower segment operation is recorded as "low, two flap low, Krönig, Doederlein, Krönig-Doederlein, Beck," and other modifications of these terms.

The mortality and morbidity of these operative procedures have been studied in detail and will be found elsewhere in this report.

## II. ECLAMPSIA AND OTHER TOXEMIAS

There were 210 cases as follows:

A. Eclampsia	104
B. Preeclamptic toxemia	46
C. Toxemia of pregnancy	41
D. Other toxemias	19

As to parity, 159 or 75.7 per cent were primigravidae, 36 had from one to five children, 3 had from six to nine children, and in 12 the parity was not stated. There were 34 maternal deaths in the whole group, a maternal mortality of 16 per cent.

Two hundred and nineteen babies are considered, including nine twin pregnancies. In all there were 48 deaths, a combined fetal and infant mortality of 21.9 per cent.

### A. ECLAMPSIA

*Maternal Mortality.*—"Eclampsia" includes only those cases in which convulsions occurred. In 104 cases there were 27 maternal deaths, a mortality of 26 per cent. After deducting four cases of vaginal cesarean section, the corrected maternal mortality of abdominal cesarean sections for eclampsia becomes 27 deaths in 100 cases, or 27 per cent.

In 70 of the 104 cases the number of convulsions was stated. Twenty-one had less than six convulsions, the number of fits in the remaining 49 being stated as "many," "several" or varying in number from 6 to 25.

In 24 cases, convulsions persisted after operation, one patient having 17. In this group of severe cases, 14 died and 10 recovered.

Of the 104 cases, 74 were not in labor, 4 were in labor less than six hours, 10 more than six hours, and in 16 the duration of labor was not stated.

In 97 cases, classical cesarean section was done, in 3 cases low section and in 4 vaginal section.

The causes of death are listed in 13 cases as, lobar pneumonia, bronchopneumonia (2), cardiac failure, ileus, acute nephritis, toxemia, pulmonary edema, shock (2), sepsis, hemiplegia, and gastric dilatation.

*Fetal and Infant Mortality.*—There are 106 babies for consideration in this group, including two twin pregnancies. Twenty-five were still-born, and 3 died later—a fetal and infant mortality of 26 per cent.

## B. PREECLAMPTIC TOXEMIA

There were 46 cases in this group, where the diagnosis was stated as "preeclamptic toxemia, or threatened or impending eclampsia." Four patients died, two of peritonitis and one of uremic coma; none of these was in labor and three were primiparae. Mortality then was 8.7 per cent.

Among the 46 cases, 41 were not in labor, 4 were in labor over six hours, and in one case there was no note.

There were 40 classical operations and six low sections.

In fetal mortality 51 babies are to be considered, as there were five cases of twin pregnancies. Seven babies were stillborn and none died later, a fetal mortality of 13.7 per cent.

## C. TOXEMIA OF PREGNANCY

In 41 cases the diagnosis was "toxemia of pregnancy." In 34 cases the patient was not in labor, in 3 a short time in labor, in 3 more than six hours, and in one this point was not stated.

Two patients died after operation. Neither was in labor. One, five and a half months pregnant, with bad urine, hypertension and optic neuritis, died on the twenty-fourth day of sepsis; the other at eight months with bad urine, hypertension and toxemia complicated by mitral stenosis, died of cerebral hemorrhage nine days after operation. Maternal mortality then was 4.9 per cent.

There were 43 babies, two cases of twins being included. Six were stillborn, and one died later, cause not stated. Fetal and infant mortality then was 16.3 per cent.

In 38 cases classical section was done, and in three low section.

## D. OTHER TOXEMIAS

The 19 cases in this class included the following reported indications:

Nephritic toxemia	11 cases
Chronic nephritis	6 cases
Hepatic toxemia	2 cases

Fifteen cases were not in labor, 3 were in labor over six hours, and one only a few hours.

There was one maternal death—a case of nephritic toxemia which died of shock twenty-three hours after operation—a maternal mortality of 5.3 per cent.

Of the 19 babies, 4 died; one was stillborn, 2 died later of prematurity and in one the cause of death was not stated.

There were 15 classical operations and 4 low sections.

## III. ANTEPARTUM HEMORRHAGE

There were 117 cases of antepartum hemorrhage—98 cases of placenta previa and 19 cases of accidental hemorrhage. In the whole

group, there were 7 maternal deaths—a mortality of 6 per cent; and 30 fetal and infant deaths—a mortality of 25.6 per cent.

*A. Placenta Previa.*—The cases are subdivided as (1) complete or central; (2) incomplete, partial, marginal or lateral; and (3) “placenta previa,” where variety was not specified. There were 7 maternal deaths in the whole group of 98 cases—a maternal mortality of 7 per cent. Subdivided mortality is as follows:

1. Complete and central, 47 cases, 2 deaths or 4.2 per cent.
2. Incomplete, etc., 13 cases, 3 deaths or 23 per cent.
3. “Placenta Previa,” 38 cases, 2 deaths or 5.3 per cent.

Three cases died of hemorrhage or shock a few hours after operation; one died of embolism on the fifth day; one died on the second day of a septic thrombus of the adnexal veins; one case complicated by chronic endocarditis died on the fifth day of heart failure; and one died of gastric dilatation.

Classical section was performed 90 times and low section 8 times.

*Fetal and Infant Mortality.*—The number of children to be considered is 100, including two twin pregnancies. The number of fetuses born dead was 10—a fetal mortality of 10 per cent. The number of babies who died during their hospital stay was 8—an infant mortality of 9 per cent in the 90 surviving births. The causes of infant deaths were: prematurity, 7; melena neonatorum, 1.

*B. Accidental Hemorrhage.*—There were 19 cases, two of which were associated with toxemia of pregnancy. There were no maternal deaths and 12 dead babies; 11 were stillborn, and one died later of prematurity—a fetal and infant mortality of 12 or 63.2 per cent.

There were 17 classical sections in this group and 2 low sections.

Seven cases were called abruptio or ablatio placentae and were apparently severe. The others were called accidental hemorrhage or separation of the placenta.

#### IV. OTHER CONDITIONS

The number of cases in this group is 544. Classification is difficult. The following plan has been followed:

1. Previous cesarean section.
2. Other operations.
3. Tumors.
4. Contraction—or retraction rings.
5. Cervical dystocia; rigidity of the cervix.
6. Congenital malformations.
7. Grave maternal diseases.
8. The fetus.
9. Rupture of the uterus.
10. Miscellaneous.



These indications are detailed in the following table:

1. Previous cesarean section	130
2. Other operations, 57 cases.	
A. <i>Abdominal</i>	
a. Ventral fixation	6
b. Ventral suspension	7
c. For prolapse of the uterus	3
d. Myomectomy	1
e. Hysterotomy	1
f. Ventral hernioplasty	1
g. Appendicectomy and oophorectomy	1
h. Unknown	4
B. <i>Vaginal</i>	
a. Amputation of the cervix	6
b. Operation on cervix	2
c. Vaginal plastic	12
d. Repair 3° lacerations	2
e. Vaginal hysterotomy	1
f. Interposition	1
g. Interposition with amputation of the cervix	1
C. <i>Combined</i>	
a. Amputation of cervix and suspension	4
b. Repair of prolapse	1
c. Amputation of cervix and oophorectomy	1
d. Amputation of cervix and laparotomy	1
e. Unknown	1
3. Tumors, 63 cases.	
a. Fibromyoma of the uterus	51
b. Ovarian tumors	6
c. Carcinoma of the vagina	1
d. Cyst of the vagina	1
e. Unclassified pelvic tumors	4
4. Contraction—or retraction rings	7
5. Cervical dystocia; rigidity of the cervix	47
6. Congenital malformations, 10 cases.	
a. Uterus didelphys, vagina duplex	3
b. Uterus bicornis unicollis	1
c. Uterus unicornis	1
d. Uterus bipartitis	1
e. Vagina duplex	1
f. Atresia of vagina	2
g. Malformation of vagina and cervix	1
7. Grave maternal diseases, 56 cases.	
a. Cardiac disease	42
b. Cardiac disease and nephritis	2
c. Pulmonary tuberculosis and pyelitis	1
d. Pulmonary tuberculosis and tuberculous hip	1
e. Pyonephrosis	1
f. Lobar pneumonia	1
g. Pyloric obstruction	1
h. Acute appendicitis	1
i. Manic depressive psychosis	1
j. Chorea gravidarum	1
k. Partial intestinal obstruction	1
l. Thyroid disturbance	1
m. Marked vaginal varicosities	1
n. Pelvic abscess	1

8. The fetus, 74 cases.	
a. Disproportion	34
Disproportion and pendulous abdomen	1
Disproportion and posterior head	2
b. Large baby	4
Large baby, face	1
c. Fetal distress	2
d. Dead fetus	2
e. Hydrocephalus	1
f. Twins, no engagement	2
Twins, polyhydramnios	1
g. Malpresentations and positions	
Breech	1
Transverse	6
Transverse and prolapsed arm	1
Posterior occiput	6
Posterior chin	1
Posterior shoulder	1
h. Previous stillbirths	8
9. Rupture of the uterus	11
10. Miscellaneous indications, 89 cases.	
a. Elderly or old primiparae	20
b. Uterine inertia	12
c. Failure to progress	12
d. Unsuccessful forceps	1
e. Obesity	1
f. Pendulous abdomen	1
g. Exostosis of pelvis	1
h. Pelvic inflammation	1
i. Exploratory laparotomy	1
j. Rectovaginal fistula	1
k. Pericervical parametritis	1
l. Vaginal obstruction	1
m. Prolapse of uterus	1
n. Patient's choice	1
o. Unknown or indefinite	34

### Group 1. Previous Cesarean Section.

In 130 cases a previous cesarean operation is given as the indication for another; in only 5 cases was there an added indication—cardiac (3), suspension of uterus (1), and toxemia (1). In 7 cases rupture of the old scar was thought to be imminent. Cases were divided as follows:

One previous section	106
Two previous sections	20
Three previous sections	3
Four previous sections	1

The operative procedures were classical 120, low 8, hysterectomy 1 and not stated 1. One case had myomectomy, and 16 were sterilized.

The maternal mortality was 1, a patient not in labor who died of peritonitis after the classical operation. In all there were 9 dead babies; 4 were stillborn, 3 died later and 2 were recorded as "dead."

In 85 cases labor had not begun; 19 were in labor less than six hours, and 14 were in labor from seven to twenty-four hours. In 12 cases there was no statement as to labor.

## Group 2. Other Operations.

This group includes all operations, other than previous cesarean section, given as the indication for operation. In 48 cases previous operation perhaps had altered the axis of the birth canal, or narrowed it. In 8 the indication is not clear.

A. *Abdominal Operations*.—There are 24 cases in this group. There were 2 maternal deaths, a mortality of 8.3 per cent. Both died of sepsis after classical cesarean. One, after a uterine fixation operation, was three days in labor. The other was nine hours in labor, and had many adhesions as a result of an operation for a pregnancy in a rudimentary uterine horn. Eight were not in labor. In one, version had been tried. There were 3 lower segment, and 21 classic operations. One fetus was stillborn after a labor of thirty-six hours, a fetal mortality of 4 per cent in 25 babies (1 case of twins).

B. *Vaginal Operations*.—In this group of 25 cases there had been 10 operations on the cervix. All but two were cases of obstructed labor, one case stated as being in labor 115 hours. One patient with cervical dystocia due to a previous plastic operation, in labor 72 hours, died of peritonitis after classical cesarean; her obstetric history showed one stillbirth, followed by three spontaneous deliveries at term.

(d) One of the two cases sectioned to protect the repair of a complete laceration of the perineum, had a large baby; the other a history of previous stillbirths. Neither was in labor.

(e) One patient who had previously undergone vaginal hysterotomy for eclampsia, was sectioned at once when her membranes ruptured.

(f and g) The two cases of interposition were not in labor. They had classical cesarean and sterilization.

Maternal mortality in this group, 1 in 25 cases or 4 per cent. Two babies were stillborn, both after thirty-six hours of labor. One fetus died of prematurity twenty-four hours after birth. In this case labor had not begun, but cesarean was performed because of previous vaginal repair and the history of two difficult forceps deliveries. Combined fetal and infant mortality 3 in 25 babies—12 per cent. There were 24 classical sections, 1 low and 5 sterilizations in this group.

C. *Combined Operations*.—Among the 8 cases in this group, 5 had amputation of the cervix as well as an abdominal operation. In one case rupture of the uterus seemed imminent after a labor of six hours. Only one case was not in labor—a II para with high anterior and posterior wall repair and suspended uterus, and breech presentation. Six operations were classic, 2 low and one patient was sterilized. There was no mortality of mother or baby in this group.

## Group 3. Tumors.

Fibromyoma of the Uterus.—Among the 51 cases, 3 mothers died, a maternal mortality of 6 per cent. In 5 cases hysterectomy was done with no deaths; in 13 cases, myomectomy with no deaths (two by low

section). In the 33 others, classical section was performed in 27, the two flap low operation in 5, and vaginal section in one. In 24 cases the patient was not in labor, and there were 3 stillborn babies.

Details of the three maternal deaths are as follows: (1) Primipara, not in labor with intact membranes and no vaginal examination, died of general peritonitis. (2) Primipara, twelve hours in labor, eighteen hours after rupture of the membranes, and no vaginal examination, died of acute gastric dilatation and ileus on the fifth day after a two flap low section. (3) Primipara not in labor with membranes intact, and no vaginal examination, died of acute gastric dilatation and shock.

The 6 ovarian tumors were 5 ovarian cysts and 1 dermoid. There were no fetal deaths. One, with a cyst blocking the pelvis, six hours in labor with intact membranes and no vaginal examination, died of shock twenty-four hours postoperative. All operations were classical, with removal of the tumor (oophorectomy).

There were no fetal or maternal mortalities in the rest of this tumor group, and all the operations were classical without any other procedure.

In the entire tumor group of 63 cases the tumor was noted as obstructing labor in 15 cases. Total maternal mortality in 63 cases was 4, or 6 per cent. Total fetal mortality was 3, or 4.8 per cent.

#### Group 4. Contraction—or Retraction Rings.

Seven cases in this group, 5 primigravidae. (1) Contraction ring, two days in labor. (2) Contraction ring, brow, in labor thirty-six hours. (3) Contraction ring, posterior occiput, forceps tried, baby stillborn. (4) Contraction ring, posterior occiput, cervix undilated after seventy-six hours; baby was stillborn, and mother died of general peritonitis four days after classic section. (5) Contraction ring, disproportion, nonengagement after thirty hours. (6) Retraction ring, dry labor twenty hours, impending rupture of uterus. (7) Impending spontaneous rupture, dry labor twelve hours, died of septicemia on the seventh day after classical section. Maternal mortality, 2 in 7 cases, 28.6 per cent. Fetal mortality 2 in 7 cases, 28.6 per cent. The operations in the group were: classical 5, low 1 and hysterectomy 1.

#### Group 5. Cervical Dystocia.

This group includes 47 cases in which failure of the cervix to dilate could not be ascribed to malformation or previous operation. In 38 cases the indication was stated simply as "cervical dystocia"; slow or faulty first stage, atresia of the cervix, and rigid or undilatable cervix were the other terms used. One case was a breech. All were in labor.

In 45 cases in which the duration of labor was stated, the time ranged from six to ninety hours, with an average duration of thirty-three hours.

There were 21 lower segment operations and 26 classical with two maternal deaths, a mortality of 4.5 per cent. One, 72 hours in labor

with membranes ruptured 114 hours, no vaginal examination, died of peritonitis and pulmonary edema on the third day after a two flap low section; the other, in labor 46 hours, with membranes intact and one vaginal examination, died of pelvic abscess and pneumonia two weeks after classical cesarean.

One baby died of intracranial hemorrhage three days after birth. Labor had lasted for 24 hours with membranes ruptured for 36 hours. Infant mortality in 48 babies (1 case of twins), 2 per cent.

#### Group 6. Congenital Malformations of the Uterus and Vagina.

These interesting anomalies have been sufficiently detailed. Of 10 cases, 5 were not in labor. Two had been sectioned before for uterus bipartis and congenital atresia of the vagina respectively. There were 9 classical sections and 1 Krönig. No maternal mortality. One baby died on the sixth day, an infant mortality of 10 per cent.

#### Group 7. Grave Maternal Diseases. 56 cases.

(a) Cardiac disease. There were 42 cases with a maternal mortality of 2 cases, or 4.8 per cent. The varieties of cardiac disease were these: (1) Mitral disease: 9 stenosis, 2 regurgitation, 10 double, and 1 "mitral disease." (2) Aortic and mitral disease 1. (3) Myocarditis 1. (4) "Cardiac disease" 18. In 9 cases, the heart was decompensated at the time of operation, 3 of these mitral disease; one case had decompensated several times during pregnancy. In 36 cases the patient was not in labor, in 5 labor had lasted from two to twenty-eight hours, and in 1 this fact was not stated. The types of operation in these 42 cases were classical 39, low 2, classical with hysterectomy 1. There were 13 patients sterilized in this group.

Details of the two fatal cases follow: chronic cardiac disease, not in labor, classical section, died of cardiac failure nine days after operation. The other case decompensated mitral stenosis with a cervical fibroid, short time in labor, died of cardiac failure eleven days after operation.

Twins, in a case of decompensated mitral stenosis, at seven and one months were stillborn. Fetal mortality among 43 babies of the cardiac group, 4.7 per cent.

#### (b-n) Other grave maternal diseases.

In this group of 14 cases there were 4 maternal deaths as follows: (1) Chronic nephritis with chronic myocarditis and fibrillation, at the seventh month, not in labor, died in coma four days after operation. (2) Lobar pneumonia two hours in labor, died of lobar pneumonia on the seventh day. (3) Pyloric obstruction, high value baby, not in labor, died five days after operation, of acidosis, ileus and shock. In these 14 cases there were 2 fetal deaths, both premature at seven months (chronic nephritis and acute appendicitis). (4) Pelvic abscess, five hours in labor, cesarean hysterectomy with bilateral salpingo-oophorectomy, died of peritonitis twenty-four hours later. To-

tal maternal mortality in the whole group of 56 cases, 6 or 10.7 per cent. Total fetal mortality in the 57 babies (2 cases of twins), 4 or 7 per cent.

#### Group 8. The Fetus.

A. In 37 cases of disproportion the weight of the baby is recorded only four times, as 8 to 12 pounds. Four were not in labor. In 33 cases the duration of labor was recorded as from one to sixty-four hours with an average duration of twenty-three hours. Two mothers died. Three babies died, one stillborn and two died later, one of cardiac anomaly. Thirty-two cases were classical section, 5 low.

Details of fatal cases follow: (1) In labor twenty-four hours, no engagement, baby 10 lbs. 4 oz., classical section, died of peritonitis four days after operation. (2) In labor six hours, baby weighed 12 lbs., classic section after attempted version; the baby was stillborn. Maternal mortality in 37 cases, 2 or 5.4 per cent. Combined fetal and infant mortality, 3 or 8.1 per cent.

B. Large baby, 5 cases. There was no maternal mortality, and 1 baby died two weeks later. Three operations were classical and 2 low. In the face case the baby was in distress but was born alive.

C. Fetal distress. Two cases of impending fetal asphyxia. One case six hours in labor with membranes ruptured, had a classical section; both mother and child lived. The other patient with membranes ruptured thirty-six hours, and cervix dilated 2 cm. after twenty-four hours of labor had a two flap low section. The mother lived, but the baby died on the third day of intracranial hemorrhage.

D. Dead fetus: (1) at term, not in labor, mother developed a psychosis on the sixth day, after classical section. (2) Eight months fetus, dead six weeks, primigravida, not in labor, hysterectomy for gangrenous uterus, tubes, and ovaries; uterine vessels thrombosed—left ovarian only vessel ligated, uneventful recovery.

E. Hydrocephalus. Eighteen hours in labor, membranes ruptured twelve hours, classical section, both mother and child lived.

F. Twins, 3 cases. All classical sections. (1) Primipara, not in labor, no engagement, died of peritonitis, the twins were stillborn. (2) Primipara, polyhydramnios, five and one-half months pregnant, not in labor, mother lived but twins were stillborn. (3) VII para, fetal dystocia, twenty-four hours in labor; both mother and child lived.

G. Malpresentations and positions, 16 cases. Fourteen operations were classical and 2 low. All were in labor. There were 4 maternal deaths. Two babies died, one stillborn and the other after five days. Details of the fatal cases follow: (1) Primigravida, right occipitoposterior position, after a test of labor, and low section, died of embolism. (2) VI para right scapula posterior position, in labor, with membranes ruptured forty-eight hours, classical section, died of embolism fifteen days postoperative. (3) Primigravida, mentoposterior

position, 108 hours in labor, with membranes ruptured 105 hours, died of shock 2 days after operation (4) II para, left posterior occiput unengaged, cervix poorly dilated, nineteen hours in labor, membranes ruptured eight hours, died of septicemia five days after classical section. Maternal mortality of this group 25 per cent.

H. Previous stillbirths. In this group of 8 cases there was no maternal or fetal mortality. None was in labor. Four cesareans were classic, 2 two flap low. One had 4 previous stillbirths, one had 3, four had 2, and two had one.

#### Group 9. Rupture of the Uterus.

In this group of 11 cases there were 3 maternal deaths and 9 fetal deaths. The causes of rupture were as follows: 3 cases had one previous cesarean section; 1 case had two cesarean sections; 1 case had 3; 3 followed forceps; 2 followed version; and in 1 the cause was unknown. Hysterectomy was done in 4 cases, and the wound resutured in 7.

Details of the fatal cases follow: (1) Primigravida, seventy-two hours in labor, attempted version, died of hemorrhage three hours after operation. (2) IV para, twenty-eight hours in labor, uterus ruptured in lower segment, cause unknown, died of shock two days after operation. (3) III para, twenty-four hours in labor, forceps applied twice, uterus ruptured in lower segment, died during hysterectomy.

Maternal mortality in 11 cases, 3 or 27.3 per cent. Fetal mortality, 9 or 81.8 per cent.

#### Group 10. Miscellaneous Indications.

(a) Elderly or old primipara. In this group of 20 cases in which "elderly primipara" or "old primipara" was the first indication for operation there were added indications in 15 cases, as follows: vertex not engaged (3), disproportion (1), breech (1), large baby, breech (1), dry labor (1), large baby, dry labor (1) and rigid cervix (7). There were 3 patients not in labor, and the others were in labor from three to seventy-two hours, with an average duration of nineteen hours. The age in 8 cases was thirty to thirty-five years, in 7 cases thirty-five to forty years, and in 5 cases forty to forty-five years. Classical operations were 13, and low 7.

In this group of 20 cases, 3 patients died, a maternal mortality of 15 per cent. One baby, monstrosity, died shortly after operation.

Details of fatal cases follow: (1) Age, thirty-three, dry labor, cervical dystocia, fetal distress, maternal exhaustion, in labor thirty hours, membranes ruptured for thirty-four hours, 4 vaginal examinations, low section, died of peritonitis and lobar pneumonia six days after operation. (2) Age forty-one, in labor four hours, membranes ruptured for seven hours, head unengaged, classical cesarean, died of spreading suppurative peritonitis. (3) Age forty-one, three days in labor, with membranes ruptured for three days, no vaginal examina-

tion, vertex unengaged, cervix poorly dilated, classical cesarean, spinal anesthesia, died of lobar pneumonia ten days after operation.

(b) Uterine inertia, 12 cases. There was no maternal or fetal mortality, in 11 cases of classical cesarean, and 1 cesarean hysterectomy in a patient ten hours in labor after induction with a bag. Thirteen babies were in this group (1 case of twins).

(c) Failure to progress. In 12 cases the indication was stated as "failure to progress" after a certain period of time, which varied from ten to seventy-two hours. All but one were primigravidae. One mother died, and one baby died three hours after delivery. Detail of fatal case: Failure to progress after eighteen hours of labor, with membranes ruptured twelve hours, and many vaginal examinations, died of peritonitis thirteen days after classical cesarean.

(d-m) No fetal deaths in this group and 1 maternal death, obesity 240 lbs., not in labor, died of cardiac failure twenty-four hours after classical cesarean.

(n) This patient had had two babies, the first stillborn, the other instrumental.

(o) In this group of 31 cases indications were either unknown or not definite. There were 2 stillborn babies. Many details are missing from this group. There was 1 maternal death, peritonitis after low section in a patient thirty-two hours in labor.

#### OPERATIONS

*Cesarean Hysterectomy.*—In the entire series of 1805 cases of cesarean section there were 21 cases of cesarean hysterectomy, distributed as follows: Class I, 6 cases with no deaths; Classes II and III, no cases; Class IV, 15 cases with 3 deaths. The indications for the six cases in Class I are detailed under Contracted Pelvis.

In the remaining 15 cases, hysterectomy was done for previous Cesarean (1), Fibromyomata (5), Contraction ring (1), Endocarditis (1), Pelvic abscess (1), Uterine inertia (1), Ruptured uterus (4), and dead fetus, gangrenous uterus (1).

Death occurred in the case of pelvic abscess, and in two cases of rupture of the uterus. Details of these cases may be found under those headings. Maternal mortality in 21 cases, 3 or 14 per cent. Deducting 4 cases of rupture of the uterus and 2 deaths, the true maternal mortality for cesarean hysterectomy is 6 per cent.

*Classical Cesarean and the Lower Segment Operation.*—Further comparison of operative procedures has been made upon the basis of the duration of labor and record of vaginal examinations done during that time.

For this analysis, the following large groups of cases were rejected as in them there were factors outside the operation itself which might well influence the result: Eclampsia and other toxemias, Antepartum



Hemorrhage, Tumors, Grave Maternal Diseases, Rupture of the Uterus, and Unknown or Indefinite. 1202 cases were available for study.

#### DEATHS AND COMPLICATIONS

In "Remarks on Puerperium" in the records submitted, the words "uneventful, normal, febrile, afebrile, no morbidity, wound infection and wound burst" appear. In many cases postoperative temperature was detailed. It was not possible, however, to draw any accurate conclusions from these statements. Only definite clinical complications were considered. Deaths have been allocated to their proper group.

TABLE II

		A. CLASSICAL		B. LOWER SEGMENT	
		CASES	DEATHS	CASES	DEATHS
1. Not in labor.	(a. No vaginal examination	329	13	55	—
Membranes intact	(b. Vaginal examination	19	—	—	—
2. Early in labor.	(a. No vaginal examination	125	3	2	—
Up to 6 hours	(b. Vaginal examination	18	1	4	1
3. Late in labor	(a. No vaginal examination	273	15	55	1
	(b. Vaginal examination	199	27	57	5
		1015	60	157	8

#### Group A. Classical. Table II.

1 a. Thirteen deaths: Embolism two cases, shock two cases, acute gastric dilatation two cases, peritonitis two cases, pneumonia three cases, thrombophlebitis and psychosis. Complications: Pyelitis two cases, phlebitis two cases, bronchitis two cases, thrombophlebitis, pneumonia, and peritonitis.

1 b. No deaths or complications.

2 a. Three deaths: Peritonitis, pneumonia, and acute gastric dilatation. No complications.

2 b. One death: Peritonitis. No complications.

#### Group B. Low. Table II.

1 a. No deaths. Complications: Pyelitis (2), embolism, thrombophlebitis.

1 b. No deaths or complications.

2 a. No deaths or complications.

2 b. One death: Cardiac failure two hours after operation. No complications.

The "Late in Labor" group includes so many cases in labor over a long period of time, that it seemed wise to subdivide it on a progressive six hour basis, Table III.

Table III. Deaths and Complications, Late in Labor.—In the following detailed statement of deaths and complications in the Late in Labor group, the numerals indicate the number of hours the patient was in labor.

TABLE III. LATE IN LABOR

A. CLASSICAL					B. LOWER SEGMENT			
HOURS IN LABOR	NO VAGINAL EXAM.		CASES VAGINAL	DEATHS	NO VAGINAL EXAM.		VAGINAL	
	CASES	DEATHS			CASES	DEATHS	CASES	DEATHS
6-12	89	5	48	4	13	—	7	—
12-18	50	2	29	4	11	—	3	—
18-24	50	2	45	5	11	—	11	—
24-30	34	2	11	—	4	—	6	2
30-36	18	1	20	2	7	—	6	1
36-42	8	—	6	1	2	—	4	1
42-48	14	1	13	—	8	—	8	1
Over 2 days	10	3	27	11	10	1	12	1
	273	16	199	27	66	1	57	6

## CLASSICAL OPERATION

*No Vaginal Examination.* 273 cases.

Sixteen deaths: Peritonitis 8 (two cases), septicemia 12, embolism 12, pneumonia 12, shock 15, cardiac failure 17, peritonitis 24, cardiac failure 24, peritonitis 25, septicemia 26, pneumonia 36, peritonitis 38, shock 48, peritonitis 72, pneumonia 72. (Numerals indicate hours in labor.)

Complications: Pulmonary infarct 8, pyelitis 7, pneumonia 12, thrombophlebitis 28 (two cases), hemorrhage 38, thrombophlebitis 46.

*Vaginal Examination.* 199 cases.

Twenty-seven deaths: Embolism 10, septicemia 12, peritonitis 12, peritonitis 14, peritonitis hemorrhage 15, peritonitis 18, septicemia 18, peritonitis 20, embolism 24, pneumonia 24, peritonitis 24 (three cases), peritonitis 32, cardiac failure 34, peritonitis 41, cardiac failure 50, pneumonia 56, infection 60, sepsis 60, pulmonary edema 72, shock 72, pneumonia 72, peritonitis 76, sepsis 72, peritonitis 96, shock 108.

Complications were, pyelitis 8, sepsis 30, and phlebitis 68.

## LOWER SEGMENT OPERATION

*No Vaginal Examination.* 66 cases.

One death, due to peritonitis and pneumonia after seventy-two hours of labor.

Complications: Pyelitis 33.

*Vaginal Examination.* 57 cases.

Six deaths: Cardiac failure 25, peritonitis 30, cardiac failure 36, peritonitis 40, hemorrhage 48, septicemia 96.

Complications: Thrombosis of femoral vein 22, and pelvic abscess 72.

In this analysis of 1805 cases of cesarean section, 374 of which, or 20.7 per cent, had been sectioned before, no attempt has been made to draw any conclusion from the material presented in the report. The figures speak for themselves, and are now available for such study.

It should be stated that, although great effort was made to secure reports from all the hospitals in our Borough, not all the operations of cesarean section performed in Brooklyn from 1921 to 1926 are included. We believe, however, that comparatively few escaped our search. All the large hospitals, public and semiprivate, and most of the smaller private institutions responded.

I wish to express my appreciation of the service of Dr. David Kuperstein who assisted me very materially in the compilation of these figures.

256 JEFFERSON AVENUE.

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### THE LONG LABOR\*

BY HAROLD BAILEY, M.D., NEW YORK

ARTICLES often appear in the literature decrying radical obstetrics. There is a general belief that the modern obstetrician is in too great a hurry and forces an operative delivery rather than awaiting the efforts of nature. However, the pendulum may swing too far toward conservatism and the labor be so prolonged that the mother's life is endangered. Anyone who has charge of an emergency or outdoor service is certain to see many cases of prolonged labor, occasionally even cases that have days rather than hours of labor.

In the course of the past six years on the Cornell teaching service at Bellevue Hospital and the Berwind Maternity Clinic there have been some 15,000 deliveries and of the deaths that occurred, five, or one in 3,000, were attributed provisionally to anesthesia. It is true that in each of the five cases there was a subsidiary diagnosis and in two cases autopsy revealed gross disturbances, nevertheless as the deaths occurred quite unexpectedly at the end of labor, it seemed that they were really due to the trials and stress of the labor itself. As these cases appeared from time to time during this period, it became evident that they had one factor in common and that was the protracted length of the labor. In an attempt to prevent future deaths of this nature we have made a study of the long labor.

There are certain conditions always present in labor that predispose toward shock at the time of delivery. In the first place, as Williamson<sup>1</sup> has demonstrated, an acidosis exists in normal labor. Secondly, toxemia before and during labor is accompanied by acidosis. Third, there is acidosis produced by the anesthesia itself. Fourth, there is a lowering of the CO<sub>2</sub> combining power that is coincident with the lowering of the blood pressure. If these factors are existent in labor of the ordinary length, how much deeper will be the acidosis produced in labor which is protracted over days. The exhaustion then becomes

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\*Read at a meeting of the Brooklyn Gynecological Society, March 2, 1928.

complete; there is an accumulation of acid bodies in the system due to muscle exertion; there is an overventilation of the lungs<sup>2</sup> due to the expulsive efforts and cries of the patient; and there is the beginning acidosis from starvation since very few of these patients can retain much of their caloric intake.

This subject will be discussed under the following headings:

1. The tendency toward death in normal labor of ordinary length.
2. Secondary inertia, usually with malposition of the head, as occiput posterior or brow.

3. Dry labor.

4. Induced labor.

5. Trial labor in relatively contracted pelves.

6. Primary inertia including the so-called rigid cervix.

I. *The Tendency Toward Death in Normal Labor of Ordinary Length.*—We offer two examples to illustrate this point. One, the death of a woman who had a preexisting toxemia; the second, a normal patient who recovered from shock that occurred after a not unduly prolonged labor.

CASE 1.—E. G., Berwind Maternity Clinic, June, 1924, colored para iv, aged thirty. This patient had a nephritic toxemia with a blood pressure of 260/160, edema and eye symptoms. She had a venesection and after a dose of castor oil, promptly went into labor and delivered spontaneously a living child, in five and one-half hours.

Not long after the return of the doctors from the case, a call was sent saying the patient was weak and sweating. Immediate response found her in moderate shock. She was given ergot and caffein by hypodermic injection. She improved and the doctors returned to the clinic. In half an hour they were again called and found her unconscious. Death resulted in fifteen minutes. There had been no excessive bleeding.

*Comment.*—It was felt that death was due to shock in a patient who had many of the predisposing tendencies mentioned above. This tendency to shock in eclampsia and chronic nephritis was fully discussed in my paper of 1911<sup>3</sup> and in Schwarz's article in 1923.<sup>4</sup>

CASE 2.—C. I., Berwind Maternity Clinic, April 4, 1927, aged twenty-three, para iii. Normal pelvis, negative medical and obstetric history. This patient had a twenty-hour labor with spontaneous delivery of a living full-term child. The placenta was expelled spontaneously and there was no excessive bleeding.

Two hours after delivery the nurse reported the patient in shock with an imperceptible pulse, rapid respirations and complaints of thirst. There was no external hemorrhage. On the arrival of the staff doctor, the blood pressure was 70/28, and the patient was in a typical condition of shock. She was given  $\frac{1}{4}$  gr. morphine, coffee by rectum, etc., and placed in the Trendelenberg position. Her condition gradually improved and at the end of six hours, the blood pressure was 110/70, and the pulse 110 and from that time on recovery was uneventful.

II. *Secondary Inertia, Usually with Malposition of the Head as Occiput Posterior or Brow.*—Delay in occiput posterior cases is so common that we all have encountered many instances. Over here in Brooklyn

the position of occiput posterior is considered so abnormal that many seek to turn the head to the anterior position at the inlet of the pelvis. I have never deemed this wise nor, I might say, justifiable.

Bony obstruction in the pelvis or manipulation by the attendant is very apt to lead to deflection which causes the long occipito-frontal diameter of the head to pass through the pelvis. Under such circumstances the head usually passes into midpelvis and lies there with both the fontanelles palpable to the examining finger and the pelvic floor is not reached until the head has undergone extreme molding. It then assumes a ball-like semblance and finally reaches the pelvic floor. This takes a long time and not infrequently the woman passes into exhaustion and secondary inertia before this happens. If the head does not advance but lies in midpelvis, there is no pressure upon the cervix which then does not dilate more than  $3\frac{1}{2}$  fingers. Frequently the membranes do not rupture but are stretched tightly over the long diameter that is presenting, so that there is no forewater to aid in dilatation. If full dilatation is awaited before proceeding to the delivery of these patients, another twenty-four hours may pass so that the labor will be forty or more hours in length.

There are two forms of treatment. The older method and the one used by nearly all general practitioners and those doing but a moderate amount of obstetrics, is to give the patient either morphine or chloral to permit her to rest. After three or four hours' sleep, labor again begins with active pains, the so-called secondary inertia vanishes and eventually the head reaches the pelvic floor, rotates to the front and delivery takes place. The disadvantage of this treatment, aside from the long labor, lies in the possibility of damage to the child from prolonged head pressure.

With the second method the patient is placed under deep ether anesthesia, the cervix manually dilated as widely as possible and the child delivered by forceps. I believe that the best form of forceps delivery, providing the cervix has passed over the head, is to rotate the head to the transverse and to apply the forceps so that there is but one application. This is an old method that has recently been popularized by H. C. Williamson<sup>5</sup> If the head is in midpelvis and molded to a ball-like shape, the Bill method is exceedingly easy, as the forceps conducts the round molded head in a circle in midpelvis, the cavity of the latter being also nearly round. The Scanzoni is another forceps procedure that, in my experience, has proved efficient. There is danger in these operative measures as the point of the forceps is very apt to tear the rim of the cervix which can never be manually dilated to the normal full dilatation. The hemorrhage that occurs following a tear must be controlled by repair. In proper hands, the advantages of this more radical method are numerous: *pari passu* with the shortening of the labor, are decreased exhaustion, and absence of shock

with the accompanying danger from anesthesia. Pressure damage to the soft parts is diminished and there is less susceptibility to sepsis.

CASE 3.—S. S., Bellevue Hospital, July 2, 1927, aged twenty-nine, para i. Not a clinic case. Forty weeks pregnant. Pains started on June 28. On June 29 the amnion broke and the pains ceased. The contractions began again on July 1. After an unsuccessful attempt at forceps by a private physician, the patient was sent to the hospital.

On admission, July second at 1:50 P.M., the patient was anemic and moderately cyanotic, having continuous rigors, no uterine contractions, blood pressure 50/20, no fetal heart heard, temperature 100°, pulse 120, respiration 28.

At 3:30 P.M. gum glucose was injected intravenously. The systolic blood pressure rose to 95. Examination: R.O.P. Dead baby. At 5:15 P.M., craniotomy. Second degree laceration. Blood pressure after delivery 70/40. Condition fair. Magendie gr.  $\frac{1}{4}$ .

July 3, temperature normal. Blood pressure 102/72. On the fourth day the patient had a chill and the temperature rose to 105°. Twenty days later she died of a pelvic abscess which had been opened in the gluteal region.

III. *Dry Labor*.—An analysis of 477 cases of dry labor on the Bellevue service, 1922 to 1926, made by Dr. Theodore Holzager, at the time a fourth year student at Cornell, shows that rupture of membranes in 86 per cent occurred before the onset or at the onset of labor. The duration of labor was not increased, the average, in 220 cases, for primiparas being thirteen hours and forty minutes and for multiparas, ten hours and ten minutes. In 77 cases, or 16.1 per cent, operative intervention was necessary. There were 12 cesareans, 10 high forceps, 16 midforceps, and 1 craniotomy. It should be understood that these cases occurred during the years in which I was carrying out trial labor, and this accounts for the cesarean sections. Dry labor was the only indication for operative interference in but 7 cases of the 77, or, as Dr. Holzager concludes, "We may assume that it played some part in leading to other factors." There was only one death in the group, a woman with a chronic cardiac condition who died of pneumonia four days postpartum. Sixteen per cent of the 477 cases were occiput posterior positions. We may conclude, therefore, that only in exceptional cases, that is, those in which dry labor accompanies malposition, malpresentation or contracted pelvis, does it enter into this discussion and then merely as a side issue.

IV. *Induced Labor*.—We no longer induce labor in patients with contracted pelvis and, aside from the bleeding cases, employ this procedure only in medical complications that threaten the life of the mother, especially preeclampsia and chronic nephritis. Induction in toxemia is apt to lead to a prolonged labor because the uterus does not respond readily to irritation. There are several points which should be understood concerning bag inductions: in the first place, we never use a bag smaller than a No. 4; in the second, as soon as the bag comes out the patient is doused with a lysol solution and the mem-

branes ruptured. Labor will frequently subside if the membranes are not artificially ruptured at this time.

CASE 4.—M. R., Bellevue Hospital, May 21, 1925, aged forty, para i, thirty-eight weeks pregnant. Patient was sent in from the prenatal clinic as a pre-eclamptic with blood pressure 160/110 and albumin 4-plus. After four days in bed with medical treatment, there was no improvement.

On May 25, at 11 A.M., a No. 4 Voorhees bag was inserted. It was expelled on May 26 at 1:30 P.M. The membranes were ruptured artificially. Three minims of pituitrin were injected for 3 doses. Labor continued but with little force to the pains. Fifty-four hours after the insertion of the bag, the patient was prepared for forceps delivery. Position R.O.P. Ether was used by the drop method on an open cone. Ten minutes after the start of the anesthesia the patient ceased to breathe. Artificial respiration was unsuccessful and the patient died. High forceps were applied to the infant who was delivered alive and was later discharged on the tenth day. Only a moderate amount of ether was used.

The autopsy showed vegetations on the mitral valve and myocardial changes which were unknown to us from the clinical findings. There was also chronic nephritis.

*Comment.*—Twenty-four hours after labor started, the CO<sub>2</sub> was 44 per cent. We believe that at the end of fifty-four hours, at the time the anesthesia was started, the CO<sub>2</sub> was probably greatly reduced, but we had no chemical determinations at that time, and we have no blood pressure readings to check the condition. This case was provisionally considered as an anesthetic death.

V. *Trial Labor in Relatively Contracted Pelves.*—We believe that a trial labor is the correct method of conducting delivery in relatively contracted pelves. Our end-results in 676 cases of contracted pelves so treated during these six years, was 3 maternal deaths.<sup>6</sup> One death was from anesthesia, and I first reported it as probably due to apnea, but I now believe that it was more probably due to acidosis.

CASE 5.—G. P., Berwind Maternity Clinic, December, 1923, aged twenty, para i. Pelvis generally contracted. Labor at term. After forty hours of active labor the patient was transferred to the hospital.

The cervix was 3 fingers dilated, the head overflexed and engaged. The patient was prepared for cesarean section. The anesthesia was started with chloroform and changed to ether. The abdomen was opened and immediately respirations ceased though the pulse remained at the wrist for several minutes. Artificial respiration was of no avail and the patient died. The uterus was immediately emptied, the fetal heart continued to beat for a few moments but attempts to establish respiration failed.

The autopsy on the mother was entirely negative as to the cause of death.

This case suggested to us that chloroform anesthesia was not responsible for the death, at least directly, for chloroform deaths are cardiac deaths rather than respiratory deaths and in this case it was clearly evident that the woman's heart continued to beat after the cessation of respirations. Yandell Henderson in 1909 suggested that fatal apnea might be due to the sudden relief of pain as by an anesthetic. With pain there is a loss of what he terms the protective CO<sub>2</sub> by excessive pulmonary ventilation.<sup>7</sup> As the CO<sub>2</sub> stimulates the re-

spiratory center, sudden relief of pain may terminate the stimulating factors which protect the individual and death from respiratory failure results. A. C. Williamson suggested that sudden anesthetic deaths may be really acidotic, preventable if due regard is given the lowered CO<sub>2</sub> tension. We feel and have repeatedly stated that tests of labor should not last for more than twelve hours of hard pains; if engagement has not then occurred, a cesarean section of the Beck type should be done without further delay and without awaiting full dilatation which has heretofore been the standard for a test of labor.

CASE 6.—H. R., Bellevue Hospital, April 28, 1927, aged twenty-one, para i. Not a clinic case. Forty weeks pregnant. Generally contracted pelvis. Labor started April 27, at 6 A.M. The patient was admitted after twenty-eight hours of labor at home under the care of a colored physician who made many vaginal examinations through an unshaved vulva and without gloves.

Vaginal examination in the hospital showed the head floating high; R.O.P.; the cervix  $4\frac{1}{2}$  fingers dilated and thin. The CO<sub>2</sub> at this time was 41 per cent and the blood pressure 134/76. Because of the exhaustion of the patient a prophylactic injection of 325 c.c. of gum glucose was started at the same time as the anesthesia. The CO<sub>2</sub> was taken and later reported as 29 per cent. The blood pressure was 150/70.

A forceps attempt at delivery was unsuccessful and was followed by prolapse of the cord which was nonpulsating. Craniotomy was then performed. The fetus weighed 3050 grams. Two hours after the delivery the CO<sub>2</sub> was 44 per cent and the blood pressure 136/70. The patient was discharged on the tenth day in good condition.

VI. *Primary Inertia Including the So-called Rigid Cervix.*—There were several cases in this group, some of them being classed as primary inertia and some as rigid cervix. There were two deaths, one apparently an anesthetic death and one obviously due to shock.

The first case illustrates primary inertia in contracted pelvis with preeclamptic toxemia.

CASE 7.—B. D., Berwind Maternity Clinic, November 10, 1927, para iv. The patient went spontaneously into labor but the pains failed to produce dilatation of the cervix. After three days of labor, she was transferred to a hospital not under our control where a cesarean section was done at once. The patient went into progressive shock and died two days later. The autopsy was negative and the clinical diagnosis of shock was accepted.

The second case illustrates primary inertia.

CASE 8.—E. R., Berwind Maternity Clinic, colored, January 28, 1926, para i, aged thirty-seven. The patient was seen on January 28 and the case "false called." The following day the pains were occurring every six minutes, the cervix was two fingers dilated, but as the pains were weak the doctor returned to the clinic and reported the case again as false called. Later that night the patient was seen again and labor was not progressing.

After thirty-nine hours of labor, the head was R.O.A. and engaged; the cervix four fingers dilated and the fetal heart 130. Six hours later (forty-five hours after labor had started) the cervix was fully dilated with the patient showing signs



of exhaustion; the pulse was 130 and fair in character. Forceps were applied by one of the visiting staff. The child was large and stillborn. The anesthesia was discontinued just prior to the completion of the forceps operation and the repair of the episiotomy. There was no abnormal bleeding. Immediately after the expulsion of the placenta the patient stopped breathing and failed to respond to all efforts at resuscitation.

*Comment.*—I have felt that this case was one of acidotic shock following the stress and exhaustion of a long labor.

CASE 9.—M. P., Berwind Maternity Clinic, January 2, 1928, aged thirty-two, para i. Past history negative. After twenty-nine hours of labor, with full dilatation and head low in the pelvis, ether anesthesia was given and as low forceps were being applied, respiration failed. The patient died despite attempts at resuscitation. The fetus was not extracted.

The provisional diagnosis was anesthetic death. No autopsy was obtained.

CASE 10.—M. K., Bellevue Hospital, July 3, 1926, aged twenty-seven, para i. Not a clinic case. Forty weeks pregnant. Normal pelvis.

The patient was admitted in shock on July 3 at 1:45 P.M. with temperature 104° and blood pressure 70/40. She was said to have been in labor for fifteen days and to have had fifteen vaginal examinations. The membranes ruptured six days before. The uterus was tonic; the cervix two and one-half fingers dilated and very rigid; the head high and fitting tightly in place; contractions every two to three minutes and uterus tonic between. Thick, yellow pus came from the uterus on examination.

Morphine gr.  $\frac{1}{4}$  given and at 4:05 P.M. an infusion of 250 c.c. gum glucose was started. At 4:35 P.M. the blood pressure was 94/10. At 4:50 P.M. blood pressure was 102/60 and craniotomy was then performed. One hour after the operation the blood pressure was 86/30 and the pulse 140. One thousand c.c. saline was injected an hour later.

During the puerperium the temperature varied from 98° to 104°. The urine showed pure culture *B. coli*. Five c.c. of boiled milk by subcutaneous injection at five different times. The patient's general condition improved very much but she left A.O.R. on the seventeenth day—the first day the temperature had been normal.

The proper treatment of cases of primary inertia is still unsolved. While morphine allows the patient to rest, it usually merely delays the progress as the patient is apt to go out of labor for twelve hours. Packing to secure dilatation is futile. At the time the patient appears for consideration it is too late to do a cesarean section, because the uterus and the amniotic sac are likely to be infected. It has been suggested by Polak that these cases be treated by packing the vagina tightly with wet cotton. In a recent case I varied this treatment by inserting a No. 4 bag and packing the vagina fully with wet gauze. In this case full dilatation occurred twenty-five hours after the insertion of the bag. The cervix was so effaced that, as the brow was presenting, version was done without injury to the mother and a living child delivered. The entire labor lasted sixty hours. While the end-results were entirely satisfactory for both mother and baby, we do not approve of a version after a long labor because of the danger of rupturing the lower uterine segment. High forceps would be a better procedure and in the event of failure one could resort to craniotomy.

## SUMMARY

A. C. Williamson has suggested that acidotic shock is the cause of sudden death from anesthesia at the end of labor. This would seem to be a logical explanation of the five anesthetic deaths that have occurred in our 15,000 deliveries during the past six years. We have shown that each of these cases had prolonged labor. When labor is prolonged, the acidosis increases hour by hour and with the lowering of the  $\text{CO}_2$  there is a coincident lowering of the blood pressure. Since we have been working on this theory, we feel that all patients who show signs of acidosis should be treated for this condition before operation is attempted.

There are two or three clinical signs that are of aid in diagnosing acidosis. The patients have bright red lips, the body surface is dry, and the blood pressure low and exhaustion marked.

In the one case in which we carried on the  $\text{CO}_2$  readings and blood pressure observations, the blood pressure did not drop in relation to the  $\text{CO}_2$  percentage as cited by Cannon in his traumatic shock cases. These  $\text{CO}_2$  readings, however, were not obtained immediately but held over until morning and perhaps, therefore, cannot be considered as accurate. Some obstetrician who has the facilities at hand should conduct a research controlling the  $\text{CO}_2$  and the blood pressure readings at six-hour intervals in labors that are from thirty to sixty hours in length. This would give us definite information as to whether the blood pressure readings might be accepted as an indication of the actual stage of acidotic shock.

Morphine is one of the first requirements for relieving the condition of acidosis. The rest afforded by  $\frac{1}{4}$  gr., in itself, tends to raise the  $\text{CO}_2$  combining power and relieves the nervous tension of the patient. Morphine should not be used in long labors for the purpose of allowing the patient to rest and then return to a stronger labor but to prepare her for operative delivery. If the labor is over twelve hours, the patient should have regular feedings of high caloric and easily assimilable food such as milk sugar with lemon or orangeade. If the labor endures for more than twenty-four hours and cannot be brought to a close because of obstetric contraindications, sugar should be given by vein. When the blood pressure is below 85, operative intervention must be postponed until it has been brought to 100 or above. This may be accomplished by the administration of 350 c.c. of gum glucose injected by vein, at a rate not greater than 4 c.c. per minute and at a temperature of  $104^\circ$ . When the blood pressure has been raised to 100, operation may be started.

Of all the forms of delayed labor, the one most difficult to treat is the so-called primary inertia and rigid cervix. It is commonly thought that the Beck type of cesarean section is the answer to this problem, but the loss of immunity from increased exhaustion and acidosis and

the entrance of infection through rupture of the membranes and repeated vaginal examinations, are contraindications. Probably the better procedure is to insert a No. 4 bag and pack the vagina with wet gauze, delivering the patient by forceps operation when dilatation has occurred.

The obstetrician must be called to account for that proportion of the maternal deaths due to the conduct of labor. Blood pressure readings and, where possible, checking of the  $\text{CO}_2$ , will confirm our clinical diagnosis of acidosis and no anesthesia should be given and no operation should be performed until the blood pressure is 100 or over. This will lead to a diminution of the sudden and obscure deaths that occur at the end of long labors.

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37 EAST SIXTY-FOURTH STREET.

(For discussion, see page 449.)

## THE BACTERIAL CONTENT OF THE UTERUS AT CESAREAN SECTION. II

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IN THE AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY for February, 1927, we published a paper entitled "The Bacterial Content of the Uterus at Cesarean Section"<sup>1</sup> which gave the clinical details of a bacteriologic study of fifty uteri at cesarean section. Of these, the cultures were sterile in twenty-eight, while in twenty-two, bacteria of various kinds were found. It is the purpose of the present paper to report the bacteriologic details of the latter twenty-two cases, whose important clinical data are given in Table I.

#### DESCRIPTION OF METHODS

All of the cultures were taken through the uterine incision, in order to insure that they could not be contaminated by the vaginal secretion. As soon as the child was delivered, but before the hands or instruments had been introduced into the lower uterine segment, a sterile cotton-covered swab was passed through the uterine incision and rubbed over the lower uterine segment, care being taken to prevent it coming in contact with any portion of the uterus except that from which the

TABLE I. GIVING CERTAIN CLINICAL DETAILS CONCERNING THE 22 CASES IN WHICH POSITIVE CULTURES WERE OBTAINED, AND INDICATING THE BACTERIA ISOLATED IN EACH INSTANCE

[illegible]

culture was desired. As soon as possible thereafter smears were made from the swab, after which it was inoculated into the following media: anaerobic and aerobic human blood agar plates, anaerobic and aerobic dextrose acid agar plates, cooked meat sealed with vaseline, anaerobic and aerobic human serum bouillon, and aerobic lactose fermented bouillon containing bromeresol-purple as an indicator. The anaerobic plates and bouillon were incubated in the anaerobe jar devised by one of us (J.H.B.<sup>2</sup>). It should be stated that in no instance were bacteria found in the primary smears which we were not able to grow in culture and to identify.

Unless otherwise stated, the bouillon and agar used were meat infusion media with a reaction of about  $P_H$  7.6. The acid agar was infusion agar with a reaction of about  $P_H$  6.7. In making the blood agar plates about 0.75 c.c. of defibrinated human blood was added to 12 c.c. of agar at a temperature of 45° C. to 50° C., and the medium was immediately inoculated and poured into Petri dishes. The terms alpha, beta, or gamma always have reference to the appearance of deep colonies in blood agar. Fermented bouillon was prepared by fermenting the meat infusion with *B. coli* over night at 37° C. before the peptone was added, according to the method of Theobald Smith.<sup>3</sup> The carbohydrates were sterilized in 10 per cent aqueous solution, and 0.5 c.c. of the solution was added aseptically to each 5 c.c. tube of fermented bouillon, as well as 5 drops of normal human serum. For the tubes containing maltose, the serum was heated to destroy the maltose-splitting enzyme (Tenbroeck<sup>4</sup>). After incubation for one week the hydrogen-ion concentrations of the fermentation tests were determined (Brown<sup>5</sup>).

In the tables the term anaerobic is only used to describe obligate anaerobes; while the term aerobic is applied to all organisms which grow aerobically. Most, if not all, of the latter were facultative organisms.

#### CLASSIFICATION OF BACTERIA

Reference to Table I shows that from the twenty-two infected uteri the fifty strains of bacteria enumerated below were isolated and studied:

<i>Staphylococcus albus</i>	9
<i>Staphylococcus aureus</i>	2
Yeasts	2
<i>Clostridium welchii</i>	3
Döderlein's <i>Bacillus</i>	1
<i>Actinomyces pseudonecrophorus</i>	3
Diphtheroids	12
Streptococci	18
Total	50

*Staphylococci*.—Passing to the detailed description of the various strains it may be said that the staphylococci isolated need no description, except to state that in each instance the presence or absence of pigment was determined by inoculation upon Loeffler's serum.

*Yeasts*.—The yeasts found in two cultures are identical with those described as frequent inhabitants of the normal vagina, so that their presence in the uterus in these cases should be regarded as an invasion upward from the vagina.

*Clostridium welchii*.—From three uteri we isolated a thick, gram-positive, encapsulated, sporulating, anaerobic, beta-hemolytic bacillus

with bluntly rounded ends. This produced stormy fermentation in milk with digestion of the casein. It also fermented starch, but did not digest egg white in bouillon.

*Döderlein's Bacillus*.—From one uterus we obtained a large, micro-aerophilic, nonhemolytic, nonsporulating, gram-positive bacillus with blunt ends. This grew best in acid dextrose agar to which 5 per cent human blood was added, and produced colonies which were slightly greenish in color but without hemolysis. Very slight growth was obtained aerobically, but it became abundant when the media were placed in the anaerobe jar or under reduced oxygen tension. Dextrose, sucrose, lactose, and maltose were fermented, but mannite, salicin, and inulin were not. Gelatin was not liquefied, but both plain and peptone milk was firmly coagulated. In cooked meat sealed with vaseline, large quantities of gas were produced, which upon analysis showed 97 per cent carbon dioxide. This organism was described by Döderlein<sup>6</sup> and others as a normal inhabitant of the vagina during pregnancy, and in this instance should probably be regarded as another instance of upward invasion from the vagina during labor.

*Actinomyces pseudonecrophorus*.—From three uteri, *Act. pseudonecrophorus* was obtained. These three strains, together with three others, namely, one obtained from a uterus the seat of a puerperal infection, one from the cervix during the last month of pregnancy and one found at the autopsy in the broad ligament of a patient dying from puerperal infection, were previously reported by us.<sup>7</sup> Consequently, we shall not repeat the details, except to state that the organism is a nonsporulating, obligate anaerobe, is gram-negative, produces gas in cooked meat sealed with vaseline, and varies greatly in length from almost coccoid forms to long, tortuous filaments. So far as we can ascertain, we were the first investigators to isolate this organism from the human genital tract.

*Diphtheroids*.—Next in frequency to the streptococci are the diphtheroid organisms, of which we isolated twelve strains from eleven of the fifty uteri cultured. The term diphtheroid is used to include all gram-positive, nonsporulating bacilli of pleomorphic diphtheroid morphology. The strains isolated in this series were all aerobic. In blood agar plates nine strains were of the gamma type, producing neither hemolysis nor discoloration, two of them produced beta zones of hemolysis, while one other produced greenish discoloration with little or no hemolysis.

The methods for studying and classifying the diphtheroids are not so well established as for the streptococci. Up to the present, we have carried out fermentation tests on only three sugars, glucose, maltose and sucrose. The results tabulated in Table II show that among the twelve strains there were at least seven different varieties. Moreover, one variety included four gamma type strains which ferment glucose

TABLE II. BIOLOGIC CHARACTERS OF THE DIPHTHEROIDS FOUND IN NORMAL UTERI

CASE NO.	RELATION TO OXYGEN	TYPE IN BLOOD AGAR	FERMENTATION REACTIONS			COOKED MEAT	
			GLUCOSE	MALTOSE	SUCROSE	GAS	DIGESTION
38	Aerobic	Alpha	<i>5.0</i>	<i>7.4</i>	<i>7.3</i>	-	-
36	Aerobic	Beta	<i>7.4</i>	<i>7.4</i>	<i>5.2</i>	-	-
48	Aerobic	Beta	<i>5.7</i>	<i>7.1</i>	<i>7.3</i>	-	-
43	Aerobic	Gamma	<i>7.2</i>	<i>7.2</i>	<i>7.3</i>	-	-
14	Aerobic	Gamma	<i>5.0</i>	<i>7.4</i>	<i>7.4</i>	-	-
25	Aerobic	Gamma	<i>5.4</i>	<i>7.3</i>	<i>7.4</i>	-	-
46	Aerobic	Gamma	<i>6.0</i>	<i>7.3</i>	<i>7.4</i>	-	-
11	Aerobic	Gamma	<i>5.0</i>	<i>7.4</i>	<i>7.4</i>	+	-
11	Aerobic	Gamma	<i>5.8</i>	<i>6.0</i>	<i>7.4</i>	-	-
50	Aerobic	Gamma	<i>5.6</i>	<i>5.8</i>	<i>5.6</i>	-	-
52	Aerobic	Gamma	<i>4.8</i>	<i>5.0</i>	<i>5.0</i>	-	-
7	Aerobic	Gamma	Not determined.				

Note: The fermentation reactions regarded as positive are italicized.

only, which does not appear to be included among the eleven types described by the British Research Council.<sup>8</sup> We have no reason to suspect that any of the diphtheroids found by us are of pathogenic significance.

*Streptococci*.—In fourteen of the fifty uteri cultured at the time of operation streptococci were found, and from them eighteen strains of streptococci were isolated and studied. Detailed information concerning them is given in Table III, from which it will be noted that twelve of the strains were strict anaerobes and would not have been detected by the ordinary aerobic methods of culture. Two strains were microaerophilic and grew best under partial oxygen tension; while four strains were aerobic or facultative. The two microaerophilic strains were apparently alike in all the test media employed; they failed to ferment any of the carbohydrates and were equally lacking in proteolytic and pathogenic powers. Three of the anaerobic strains produced beta zones of hemolysis in blood agar plates. No anaerobic alpha strains were found. Nine of the anaerobic strains were of the gamma type and produced neither hemolysis nor discoloration of the medium. One of the anaerobic gamma strains (51) resembled the microaerophilic strains except in its strict anaerobiosis. Two other nonfermenting anaerobic strains (28 and 37) differed from 51 only in their ability to produce gas in cooked meat medium. One of the anaerobic beta strains (25) was also a nonfermenter, but did liquefy gelatin. Two other anaerobic gamma strains (48 and 54) were apparently alike, fermenting only glucose and maltose. Among the other strains, anaerobic and aerobic, there were no duplicates; all showed differences in fermentation reactions or in other characters studied.

If the four aerobic strains are classified according to Holman's<sup>9</sup> classification, the two beta strains must be regarded as *Streptococcus pyogenes*, the alpha strain as *Streptococcus equinus* and the gamma strain as *Streptococcus ignavus*. However, we would prefer to con-

TABLE III. BIOLOGIC CHARACTERS OF THE STREPTOCOCCI FOUND IN NORMAL UTERI

CASE NO.	RELATION TO OXYGEN	TYPE IN BLOOD AGAR	FERMENTATION						REACTIONS		MILK		COOKED MEAT		GELATIN LIQUID.		PATHO-GENICITY		NOMEN-CLATURE (HOLMAN <sup>9</sup> OR PREVOT <sup>10</sup> )	DESIGNATION (BROWN <sup>11</sup> )
			GLUCOSE	MALTOSE	SUCROSE	LACTOSE	RAFFINOSE	INULIN	MANNITE	SALICIN	COAG.	DIGEST.	GAS	DIGEST.	GELATIN LIQUID.		MOUSE	RABBIT		
			4.7	5.0	5.2	7.4	7.4	7.4	7.3	5.4	-	-	-	-	-	-	+	-		
37	Aerobic	Alpha (viridans)																	<i>S. equinus</i>	Aerobic $\beta$ 1.2
52	Aerobic	Beta	5.0	5.1	5.2	5.3	5.3	7.3	7.4	5.3	+	-	-	-	-	-	+	-	<i>S. pyogenes</i>	Aerobic $\gamma$ 4.6
46	Aerobic	Beta	6.2	6.4	6.4	6.6	6.6	7.2	7.2	6.3	-	-	+	-	-	-	-	-	<i>S. pyogenes</i>	
46	Aerobic	Gamma	5.5	5.6	7.2	7.2	7.2	7.4	7.4	7.2	-	-	-	-	-	-	-	-		
11	Microaerophilic	Gamma	7.3	7.2	7.4	7.4	7.4	7.4	7.4	7.3	-	-	-	-	-	-	-	-		
29	Microaerophilic	Gamma	7.3	7.2	7.4	7.4	7.4	7.3	7.4	7.4	-	-	-	-	-	-	-	-		
25	Anaerobic	Beta	7.2	7.2	7.4	7.4	7.4	7.2	7.4	7.3	-	-	-	-	+	-	-	-	<i>S. intermedius</i>	Anaerobic $\beta$ 0.0
49	Anaerobic	Beta	5.7	6.2	7.2	6.1	7.1	7.4	7.4	7.2	+	-	-	-	-	-	-	-	<i>S. intermedius</i>	
48	Anaerobic	Beta	6.0	6.3	7.4	6.2	7.4	7.4	7.4	6.5	+	-	-	-	-	-	-	-		
7	Anaerobic	Gamma	Not studied																	
28	Anaerobic	Gamma	7.2	7.2	7.2	7.3	7.3	7.4	7.4	7.3	-	-	+	-	-	-	-	-	Group A1	Anaerobic $\gamma$ 0.0
37	Anaerobic	Gamma	7.2	7.3	7.3	7.2	7.3	7.4	7.4	7.2	-	-	+	-	-	-	-	-	Group A1	
51	Anaerobic	Gamma	7.2	7.2	7.2	7.3	7.3	7.3	7.1	7.1	-	-	-	-	-	-	-	-	<i>S. micros</i>	
48	Anaerobic	Gamma	5.8	6.0	7.2	7.3	7.3	7.4	7.4	7.2	-	-	-	-	-	-	-	-	<i>S. micros</i>	
54	Anaerobic	Gamma	5.5	5.6	6.4	7.2	7.2	7.2	7.2	7.2	-	-	-	-	-	-	-	+	<i>S. micros</i>	Anaerobic $\gamma$ 3.1
25	Anaerobic	Gamma	5.3	5.5	5.3	7.4	7.4	7.2	7.2	5.3	-	-	-	-	-	-	-	-		
44	Anaerobic	Gamma	6.3	6.4	7.2	6.4	7.2	7.1	7.1	7.1	+	-	+	-	-	-	-	-	<i>S. micros</i>	Anaerobic $\gamma$ 1.4
34	Anaerobic	Gamma	4.8	5.2	4.8	4.8	5.8	5.4	7.3	6.0	-	-	+	-	-	-	-	-		

Note: The fermentation reactions regarded as positive are italicized.

Holman utilized only three carbohydrates (mannite, lactose, and salicin) in his classification of the aerobic streptococci. Prevot did not utilize carbohydrate fermentations in his classification of streptococci. Our attempt to identify some of our strains with those described by him is based upon gas production, coagulation of milk and liquefaction of gelatin. His Group A1 includes three species, *S. fetidus*, *S. anaerobius*, and *S. putridus*.



fine the latter name to alpha strains. Furthermore, in Table III we have given certain designations from the classification of Prevot<sup>10</sup> which might be applied to some of the anaerobic strains, but we do not find his data sufficiently characteristic to enable us to identify our strains with his.

For the present we do not feel justified in attaching special significance to any of the individual strains of streptococci found, but certain outstanding features may be recognized when these eighteen strains are regarded broadly: (1) The predominance of anaerobic streptococci. (2) The predominance of streptococci of the gamma type in blood agar; the presence of both aerobic and anaerobic beta types; and the almost complete absence of the alpha type. (3) The absence of *Streptococcus fecalis* and other mannite fermenters, which possibly indicates that the streptococci found in the uterus are not of fecal origin. (4) The low pathogenicity of these streptococci for mice and rabbits.

#### SUMMARY

Of fifty uteri cultured at cesarean section, twenty-two were found infected. With one exception the puerperia of these patients were febrile, but all recovered. In ten cases the incisions healed poorly. From eight of these cases either *Actinomyces pseudonecrophorus* or beta-hemolytic streptococci were isolated. The incisions of all the patients harboring these organisms healed poorly. *Clostridium welchii* also was found in three cases, but there was no gross evidence of gas bacillus infection. The gamma type of anaerobic streptococci showed wide differences in fermentation reactions. In one patient (34), whose wound healed poorly, we obtained a pure culture of an anaerobic gamma type streptococcus which was an active fermenter of all the test substances except mannite. There was no obvious relation between the course of the puerperium and the presence of diphtheroid bacilli in the uterus.

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## CERVICAL INFECTIONS IN THE PUERPERIUM\*

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THIS is an old subject dressed in new clothes, and it is being presented as a new dogma. Quite recently, during the symposium upon puerperal infection at the London Medical Congress, an author of international repute stated that the incidence of morbidity in the puerperium is just as great as before the days of Pasteur and Lister, but that mortality in the puerperium, on the other hand, had fallen very considerably.

It is a fact, well known to those who have reached the meridian, that grave puerperal sepsis has diminished to a very remarkable degree. But puerperal morbidity is still all too frequent a complication, and one may well be astounded and one's interest at once be arrested by this grave statement that morbidity is as prevalent today as in the days before asepsis. It is worth not a little study to be able either to refute or to substantiate such a wide sweeping statement.

The subject matter of this paper was given before the Philadelphia Obstetrical Society in November, 1926. The work was not published, but has been held over until the present in order that the study might be repeated, and the work allowed to mature and stand the test of corroboration. It now appears after almost two years of delay.

The American College of Surgeons has laid down a minimum standard for morbidity; namely, a temperature of  $100.4^{\circ}$  during any two consecutive days, exclusive of the first day postpartum. We shall ask you to ignore this standard tonight and to substitute another and a more critical one.

Let us take this high standard, to recognize as an expression of morbidity, any temperature that rises above 99 degrees on three consecutive days after the first day postpartum. Then augment this standard by all those cases which, though without temperature whatsoever, yet are morbid—cases which our surgical conscience and our surgical experience tell us indubitably are septic and morbid. Statistics, as you all know, depend for their usefulness or uselessness—we repeat, statistics in their final analysis depend upon the compiler's conscience and experience.

We all know that a very high percentage of morbidity, yes, the great majority of morbid cases, will never be recorded if standardized by the high temperature records as set by the British and American colleges of surgeons. The morbidity as gathered by this standard varies from 2.4 to 12.4. Yet the figures as judged by the standard that we have asked you to set up, which recognizes any temperature

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\*Read at a meeting of the New York Obstetrical Society, March 13, 1928.

of 99 degrees or over for three days, plus the inclusion of obviously morbid cases without temperature, raises the morbidity in the Hebrew Maternity Hospital from 8.5 per cent to between 30 and 40 per cent.

Let us explain. Upon Goodall's return from an absence of a few days recently, his house surgeon said to him: "This case, sir, is one of pleurisy." We always look upon an acute chest pain in the puerperium as suspicious. We examined the patient carefully and found signs of slight pelvic trouble. Two days later she developed thrombophlebitis of the internal saphenous vein. She had had a temperature for only one day of 100 degrees throughout her whole puerperium, and within the same week we had two such cases of lung infarcts and signs of thrombophlebitis without the temperature rising even to 99 degrees. Such cases do not fall within even the minimum standard of 99 degrees for three consecutive days, and can be included only if the experience of the accoucheur permits of a proper diagnosis, and if his conscience prompts disclosure.

Yet who will doubt the great danger that attends such cases of thrombophlebitis. Personally, we look upon such afebrile thrombophlebitides with the greatest respect, and we breathe more freely as days pass without serious consequences. In fact, we have come to the conclusion that the cases of thrombophlebitis most to be feared are the lowly febrile and the afebrile, or the highly febrile cases when passing into the convalescent stage. I have rarely, if ever, seen a case of embolism in a virulent thrombophlebitis except during the stage of defervescence.

Now, after going over our records and notes, after eliminating everything that is of an extrinsic, extrapelvic nature, and including everything that is definitely pelvic and septic, our morbidity rises to between 30 and 40 per cent. A vast discrepancy, you will state, as compared with 8.5 if taken according to accepted standards.

A critical review of several hundreds of hospital cases has brought out the following interesting facts: that roughly 50 per cent of multiparae, as against 30 per cent of primiparae, show some morbidity in the puerperium. In other words, that every second multipara as compared with every third primipara has an eventful recovery. Many of these morbid conditions are of short duration and remain undiagnosed, but are undoubted infections.

Yet, we fancy, that is just the opposite of what one would expect. There is in the case of the primipara so much more traumatism during labor, labor is usually so much longer, the exhaustion so much greater, the manipulations so much more frequently necessary, that these statistics came as a bit of astonishment. We have lately spoken to some of our confrères, and they were unanimous that recoveries in multiparae are more eventful than the average puerperium of the primiparae. How can we explain the anomaly? The research that follows was not

undertaken with a view to prove or disprove the above statement. The greater incidence of morbidity in multiparae was discovered long after the work was under way. So that the thought could not have influenced the results.

Struck by the frequency with which one met morbidity in the Hebrew Maternity Hospital's public wards—a morbidity marked chiefly by subinvolutions, with or without temperature; or by low temperature with or without increase of pulse rate; or by the frequent incidence of thrombophlebitis in apparently simple, uncomplicated labors—we were prompted to investigate and endeavor to find the cause, or causes. We undertook to examine every woman who showed any morbid state. We had done this in our private practice previously, and had laid the foundation of this work.

The results of these examinations were astonishing. As a rule, we did not examine until the fifth day postpartum, and in most cases not until some sign of morbidity had manifested itself, though there were many exceptions to this rule.

The fact we want to establish is this, that the conditions to be described cannot be attributed to the examination, for most of the morbid states were found at the first examination. Many who showed no appreciable signs of morbidity were found to be infected when examined. In all, 145 cases, private and public, have been submitted to examination, some of them repeatedly, to watch the progress of the infection.

In the vast majority of the morbid cases the lesion was found to be cervical in origin. On examination of these cases, one was struck with the frequency with which one saw a thin, delicate streptococcic membrane covering the os and the cervical canal as far as the eye could see. This membranous development was very thin, and seemed mostly on the surface of the cervical mucosa. It could be easily wiped off without causing any active bleeding. The membrane was found in about 5 per cent of all cases examined. Smears showed streptococci in very large numbers, and in most cases it was the preponderant organism.

In other cases the cervix would be found granulating, bleeding readily on contact, and a mucopurulent discharge escaping from these surfaces, mostly mixed infections. On digital examination, one frequently found a stiffening of the fornix on one side and tenderness on pressure. And yet the presence of this infected area high up, with drainage over a sutured episiotomy, or repair, was not inconsistent with primary union of the perineum.

This condition has been found so repeatedly that not a shadow of doubt can exist as to its frequency and character. During the period of this research only one repaired perineum broke down, and that was in a woman recovering from eclampsia and a version with breech de-

livery. She had a slight infection higher up, and owing to her greatly lowered resistance, the perineal stitches did not hold.

We attempted to get drawings of these cervical infections, but the picture changes so rapidly that, like throat membranes, today they are present and tomorrow they are gone, and it is only by repeated examinations that one can detect their frequency. In our first examinations we stumbled across the membranous types by mere chance, and later were able to demonstrate them quite frequently.

Endeavor to culture the common organisms of cervical infection, gave us no further information than that which could be obtained from smears. After all, bacteriologists—apart from their work in serology and immunity—have been contented to give us a morphologic classification of microbes—a poor aid to clinicians, you must readily admit. What does the fact that an organism grows in chains or groups mean to clinicians? What does an hemolyzing or non-hemolyzing streptococcus mean to us? To the inexperienced it may carry fear or false sense of security. But to the experienced clinician it means nothing. An hemolyzing streptococcus can be a most inoffensive organism, and the nonhemolyzing can be a most dangerous enemy, and vice versa. So where do bacteriologists stand in their relation to infection?

We are convinced that microbial protoplasm, like human agglomerate protoplasm, is changed by character of food and environment and that through successive generations hereditary characters become permanent, and that an organism once markedly attenuated may not easily regain its previous virulence; organisms divide so rapidly that new properties are prone to become permanent. Just as food and climate (environment) have made the different races, these have become fixed types.

It is our forecast that specificity in microbes is more a matter of virulence or attenuation, coupled with the site of election of infection, than is morphology or any other physical property. If attenuation by unfavorable food does not lead to fixed properties, how can we explain the Calmette immunity tests for tuberculosis? My point is that morphology in bacteriology has no significance in clinical obstetrics. So we abandoned the cultures for the smears, as giving us a better idea of the predominant organism in any given cervical infection.

*Argument.*—Though our records prove that infections are more common in the multiparae than in the primiparae, yet we know that when infections in the primiparae occur, they are usually more virulent and more dangerous. The reason for the greater frequency and milder type of infection in the multiparae can readily be explained by two factors: first, by the greater incidence of cervical infections in the multiparae, cervical infections antedating the eventful puerperium, and, second, the greater incidence of pathogenic organisms in the

lower genital tract, due to gaping vulva, cystocele and rectocele, and other lesions resulting from earlier pregnancies.

Fulkerson in a recent work pointed out that endocervical infections are found in the multipara and nullipara in the ratio of 93 per cent to 7 per cent, respectively. Of the married women, over 80 per cent had been pregnant. This and the smallness of the nulliparous cases, supports the conclusions that the traumatism of labor and abortion are the chief factors in producing the disease, all of which tends to substantiate the knowledge that the cervix is a frequent offending organ in the puerperium.

What is the real sequence of events? Let us endeavor to outline it. A primipara is recently delivered. She sustains a tear and traumatism of the cervix. They all do. She lies in bed on her back. The vagina is at an angle of 45 degrees with the bed. Drainage is up hill, as it were. The vault of the vagina remains full of lochia, which she partly empties each time she voids. After the third day postpartum, nearly all authors agree, the lochia is no longer sterile. The cervix is bathed in this infected lochia. The cervix could resist this infection were it intact and healthy, but it has been torn; it is a healing, granulating wound, injured by labor. Is it any wonder then that 80 per cent of parous women suffer from endocervical lesions, of a catarrhal nature—endocervical lesions ready to flare into smouldering activity by the traumatism of a subsequent labor?

An interesting fact, somewhat germane to the subject matter under discussion, is that these cervical lesions are the frequent cause of delay in dilatation of the cervix in multiparae, causing by the irritation of catarrh a spasm, a resistance to dilatation. In such cases morphine or heroin relieves the irritability and spasm and dilatation follows quickly.

May I read an extract from Mr. Victor Bonney on the occasion of the discussion on puerperal sepsis at the Congress of Obstetrics and Gynecology, held last year.

He recalled a paper which he had read before a similar gathering, in which he had advanced the conclusion that puerperal sepsis today was principally autogenetic. He had pointed to the precautions which he had taken for many years against what he called extrinsic infection, and to the fact that in spite of all such precautions the morbidity was very little altered. No one would deny, he adds, the possibility of conveying germs from without into the genital canal, but his contention had been, and still remained, that that occurred in only a small proportion of the cases.

All the measures inculcated by the teachers had for their object the prevention of extrinsic sepsis, and yet the figures advanced that day seemed to prove very conclusively that sepsis was increasing. He noticed that in one of the reports the origin of the sepsis in very many of the cases was not stated. He wished the compilers of these statistics had been a little bolder, and had described these as cases of intrinsic sepsis. If the bulk of puerperal sepsis had been extrinsic, then the measures which had been taken for many years, and recently with increasing

rigour would have occasioned a marked fall in the incidence, whereas any decline had been no greater than one might have expected if only a small proportion of the cases were of extrinsic origin. As a parallel instance, he mentioned that at the Chelsea Hospital for Women in 1900 the mortality rate for major abdominal operations was from 5 to 6 per cent, and by 1906 it has fallen to 1.6 per cent, at about which figure it had remained. During the period 1900 to 1906 gloves had been introduced, and had protected the patient against extrinsic sepsis, but were of no value against intrinsic sepsis, which continued in spite of these measures.

Whitridge Williams stated at that same congress quoted above that it would be unfortunate if the point of view, which regarded puerperal infection as in great part contact infection, were abandoned. If Williams will lay the stress on the words "in great part," not much objection can be raised. But why would it be unfortunate? We think that most of us are ready to assume the blame, if any blame attaches to the handling of a case. But who of us wishes to assume unjustifiable censure?

Not so many years ago, the public blamed the nurse always when septic trouble ensued, and this often, we fear, with the doctor's tacit connivance. Today the pendulum has swung to the other extreme and the physician is held responsible for every untoward symptom of the puerperium, owing to the widespread, yes, almost universal belief that infection is always introduced from without, and implies a culpable breach of technic.

Let us have the truth, the cost will adjust itself. Will the knowledge that infections are frequently intrinsic be used as an excuse for any laxness in present aseptic technic? We think not. That many of these infections are intrinsic and cervical is further borne out by the study of subinvolution. Subinvolution is probably the most common complication of the puerperium. It is always a result of something antecedent. How often (in the absence of other signs) we hear clinicians say it is the result of multiparity, or too frequent child-bearing. We have examined many of these and nearly always find the cause to be unsuspected cervical infection. Moreover, this is further confirmed by Goodall's researches in chronic metritis, which, as you all know, is the result of a neglected subinvolution, and therefore the result of an infected pregnancy.

In nearly all the cases of chronic metritis the cervix is involved in a process which is generally spoken of as chronic cervicitis. The cervix is hard, cystic, enlarged, and its infection is the primary cause of the continued subinvolution of the superimposed uterus. This is not a mere accidental association of a diseased cervix and a diseased uterus. In the vast majority of cases the primary lesion is the cervical disease.

One of us spent many years of research to bring our knowledge of the puerperal uterus and of chronic metritis to a finality. The term chronic metritis is a misnomer, for the process is not an inflammation, but a lack of destruction and a lack of absorption of superfluous, use-

less tissue, following a miscarriage or full-term labor. In the presence of infection, the more delicate and more highly organized muscle succumbs, but the more resistant, less highly organized connective tissues remain. The first stage is a large, soft uterus; the last stage is a large, hard uterus. It should be termed chronic subinvolution.

The uterus weighs approximately 1000 grams immediately after labor, and the uterus in the quiescent stage weighs about 75 grams, so that the puerperal woman has to get rid of about 900 grams of superfluous tissue. Two factors enter into the destructive process, namely, contraction and retraction, and one factor enters into absorption, the activity of cell metabolism. Infection arrests both retraction and contraction of the uterus, and thereby arrests destruction.

Now we have found that in most cases of subinvolution there is a silent infection of the cervical canal, occasionally membranous, and that it is the continuation of this which leads to hypertrophy of the cervix, and the chronic subinvolution is the result. Of course many cases of chronic metritis are primarily uterine in origin, especially those following an infected abortion. But has it never struck you how frequently chronic metritis is uncomplicated by any peritoneal, adnexal, or parametrial disease? Only the cervix is involved, and the cervical condition, with its hypertrophy and cystic disease, is a perfect picture of infection.

*Treatment.*—It will be gathered from the foregoing that there are intrinsic and extrinsic infections. There is nothing new to be added to preventive measures used to bring about complete asepsis of the external genitals. And the knowledge that some infections are intrinsic should not justify one in relaxing one iota in making his surgical technic as perfect as possible.

Of the intrinsic infections, I think from what has gone before, we must divide the cases into two groups. The first group will consist of those cases in which the vagina is the harbinger of pathogenetic organisms, but these have not been long enough in the genitals to secure an implantation. They have had access to the home, so to speak, but are not of the household. The inner genitals are the harbingers but not the host; among the common causes are self-infection and intercourse. Then there is the second great group, much the more frequent in our experience, in which there is a definite microbic disease of the cervix, with the pathogenetic organism in the tissues in a latent or dormant stage. To overcome the former group of pathogenetic organisms free in the genitals, we have adopted a form of treatment, which so far has given us very encouraging results. Dr. Mayes, of Brooklyn, has carried out practically the same treatment with apparently the same encouraging results.

Our treatment consisted in shaving and performing external toilet of the vulva after the usual enema. When this was completed, a ster-



ile glass catheter was passed into the vagina up to the cervix, and the vagina filled with a 2 per cent mercurochrome solution, and the vulva painted with the same strength of solution. Mayes used 4 per cent solution and repeated the vaginal injection if labor was unduly prolonged. We heartily approve of this. The same technic has been carried out in 100 cases with 100 controls in the Royal Victoria Hospital, with very gratifying similar results.

Moreover, our patients received daily an intravaginal injection of 2 per cent solution throughout the first seven days of the puerperium. There has been only one case of fetid lochia since this practice was adopted. The incidence of mild infection has been considerably reduced and complications lessened. Stay in the hospital has been greatly lessened, and in all of these factors Mayes' work and our work are in complete accord.

In the second group of cases, where an endocervical infection antedated labor, unfortunately treatment of any kind will bear but lightly upon this type of infection. The microorganisms are latent, dormant, in the catarrhal and diseased cervix. They may remain dormant for years, producing slow, progressive hypertrophy of tissues by their irritating action. These, under the influence of the traumatism of labor, light into activity, and we think are accountable for the great majority of intrinsic infections during the puerperium—more especially are they accountable for the attenuated infection with slight morbidity, and therefore for many of the silent or semi-silent thrombophlebitides. The symptoms arising out of this type of infection are usually slight, but frequently prolonged, because they are seldom acute.

These are met with mostly in the multiparae. Vaginal injections will not materially alter their action, for they are already in the tissues. But injections, we can conceive, might prevent or minimize re-implantation upon new raw surfaces. We fear that the only treatment that will materially diminish this type of case must antedate the pregnancy.

We wish to put forth an ardent plea for active treatment of every form of endocervicitis, by cautery and amputation, to remove areas of ectropion, and we especially urge that this form of treatment should follow as soon as judicious upon the labor and puerperium. Undoubtedly, the vast majority of such cases date their initial lesion and infection to the tears and traumatism of labor, and to subsequent infection of these traumatized areas by the infected lochia after the third day postpartum. In our service every patient is examined with speculum on discharge and also six weeks later. Treatment is applied from six to eight weeks postpartum.

To recapitulate.—Morbidity from childbirth does not seem to have appreciably changed in totality since the days before antisepsis and

asepsis, but morbidity has changed very appreciably in character. The severe types have been very considerably reduced, except in cases of induced abortions. This change is due to the improved technic and the lessened extrinsic infection. The high percentage of virulent infection in induced abortions bespeaks a lack of aseptic technic, and is a vivid reminder of morbid conditions in obstetrics well within the recollection of most of us.

The present day high percentage of morbidity of the less virulent types, the higher percentage of morbidity in multiparae as compared with primiparae; the marked frequency of subinvolution without readily appreciable cause; the common occurrence of thrombophlebitis of the pelvic vessels without involvement of other tissues than the veins; the frequency of remote thrombophlebitides, all argue for an attenuated infection, and for an agency that is beyond the reach of our almost perfect vulvar aseptic technic.

The frequency with which we have been able to demonstrate primary infection in the cervix in the early days of the puerperium, and the higher incidence of morbidity in the multiparae; the incidence of cervical infection in cases of subinvolution, without other symptoms, and lastly the marked association of grave cervical alteration in cases of chronic metritis, all lend support to the hypothesis that chronic endocervicitis and cervicitis are the underlying causes of most of the mild cases of morbidity which prevail today in all the clinics.

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(For discussion, see page 440.)

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Schneider, G. H.: The Question of Rectal or Vaginal Examination in Obstetrics and Gynecology. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1927, lxxvii, 401.

In the opinion of the author, vaginal examinations in obstetrics should be made only for a therapeutic purpose, and be avoided for diagnostic purposes alone. However, before every vaginal operation, this form of examination must be made for it cannot be replaced by a rectal examination. For gynecologic purposes, a rectovaginal examination is better than a rectal or a vaginal one alone.

J. P. GREENHILL.

# CYSTIC CERVICITIS, WITH SPECIAL REFERENCE TO TREATMENT BY CAUTERIZATION

## A CLINICAL STUDY OF 1031 CASES

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THE successful treatment of chronic cystic cervicitis consists in the eradication of the mucous glands of the cervix. The glandular tissue may be removed by amputation of the cervix or by thorough cauterization.

The histories in the Mayo Clinic of cases diagnosed cystic cervicitis were studied in order to evaluate the results following cauterization of the cervix. The results were compared with those of a series of cases in which the cervix was amputated for the same condition. Only those cases were studied in which the cervix was so extensively involved that hospital care and treatment under an anesthetic were necessary. Lesions that could be treated by local applications of antiseptics, caustics, or astringents were not included nor were cases in which cauterization could be carried out in the office. Cases in which amputation of the cervix for prolapse had been performed, even though the cervix was cystic, were not included in the comparison.

The two groups were analyzed as to age incidence, marital state, pregnancies, cardinal symptoms, symptoms referable to the pelvis, complicating disorders and variations in menstruation. An attempt was made to determine a criterion whereby it would be possible to decide whether amputation or cautery was indicated in specific cases.

In the investigation questionnaires were sent only to patients in the child-bearing age whose conditions would not prevent conception or pregnancy. Cases in which treatment with radium or roentgen rays had been given were excluded, also those in which ligation of the tubes, ovariectomy, or hysterectomy had been performed. In evaluating the results, an analysis was made of the general health of the patient, the improvement of the pelvic symptoms, the necessity for subsequent treatment, if any, and the number of subsequent pregnancies.

### INCIDENCE

During the period from 1919 to 1926 inclusive, approximately 226,900 women were examined for all conditions. Cystic cervicitis was sufficiently marked to be diagnosed by the general history in only 2368

cases (1.05 per cent). Of 1031 of these cases diagnosed cystic cervicitis, surgically or pathologically, treatment was carried out in 550 (53.5 per cent) by cautery to the cervix and in 481 (46.5 per cent) by amputation of the cervix. In 1337 there were complicating conditions which were treated either medically or surgically. Excluding amputations of the cervix for prolapse, and cautery after the removal of cervical polyps, there remain 661 cases of cervicitis treated in the hospital, 366 (55.5 per cent) by cautery and 295 (44.5 per cent) by amputation. This group of cases is the basis for our study.

The incidence of cervicitis found in women examined at the Mayo Clinic seems small when compared with statistics compiled in gynecologic clinics elsewhere. At Cornell University Clinic the incidence reported by Fulkerton was 33 per cent, at the Long Island College Hospital, Mathews reported 75 per cent, and at the Woman's Hospital, New York, Rawls reported cervical operation in 11 per cent of 6503 patients examined for gynecologic disorders.

The small incidence at the Mayo Clinic may be accounted for in several ways. The clinic is situated in a small city, and the majority of patients come from a considerable distance, so that fewer patients come for minor complaints than come to city dispensaries. The communities from which the patients come are peopled by thrifty farmers whose wives are healthy, free from infection, and who do not consult a physician unless their complaints are quite annoying. If cervicitis, giving few if any symptoms, is present in a case in which there is a more urgent condition, it is usually not treated. However, since the cervix in married women is examined as a routine, it is doubtful if any severely infected cervix would escape diagnosis.

In considering the female population as a whole, it is probable that these statistics represent fairly accurately the incidence of cystic cervicitis. The patients in the large gynecologic clinics are there because of a pelvic complaint; these represent a small proportion of the general population.

#### AGE INCIDENCE

The age incidence in cases of cystic cervicitis treated surgically at the Mayo Clinic has been determined. Two patients (0.3 per cent) aged less than twenty were treated by cauterization. Forty-three patients (6 per cent) between twenty and thirty were treated by cauterization, and thirty-nine (5.9 per cent) were treated by amputation. One hundred fifty-six (23.6 per cent) between thirty-one and forty were treated by cauterization, and 126 (19 per cent) were treated by amputation. One hundred thirty-six (20.6 per cent) between forty-one and fifty were treated by cauterization, and 115 (17.5 per cent) by amputation. Thirty-one (4.7 per cent) between fifty-one and sixty years were treated by cauterization, and sixteen (2.4 per cent) by amputation.

Fifty-four and eight-tenths per cent of the patients treated by cautery for cervicitis were aged less than forty; 56 per cent treated by amputation of the cervix were less than forty. The fact that almost half the patients were more than forty, that is, past the most productive period, is not an indication that cervicitis does not occur frequently in younger women, but that the more conservative methods of local medication or cautery in the office are attempted at this age. Injuries and inflammations can be rendered harmless and practically symptomless in the younger woman by delicate linear cauterization in the office. Operative measures are not advised unless the condition has advanced to the stage at which such treatment has become ineffective.

#### MARITAL STATE AND NUMBER OF PREGNANCIES

Ten of the patients treated by cauterization and two treated by amputation were unmarried; thirty-one treated by cauterization and eight treated by amputation were married but childless; eighty-eight treated by cauterization and fifty-seven treated by amputation had one child; seventy-four treated by cauterization and seventy-eight treated by amputation had two children; forty-three treated by cauterization and forty-two treated by amputation had three children, and 110 treated by cauterization and eighty-six treated by amputation had four or more children. Eighteen patients treated by cauterization and twenty patients treated by amputation had had one miscarriage; eighteen treated by cauterization and ten treated by amputation had had two miscarriages, and fourteen treated by cauterization and sixteen treated by amputation had had three or more miscarriages. In two of the cases in which cauterization was employed and in seven in which amputation was employed there had been one stillbirth. In two cases in which cauterization was employed and in one in which amputation was employed there had been two stillbirths.

Of the entire group 7.7 per cent had not borne children, 22.7 per cent had had one child or one miscarriage, 69.6 per cent had had multiple pregnancies; 32.2 per cent had had more than three children. Cautery was employed more often in cases of sterility than was amputation of the cervix. The number of married women without children was small, and only fifteen of the patients mentioned sterility as a complaint. Fulkerton reported 19.9 per cent sterile marriages in his series. The conclusion is that trauma due to multiple pregnancies is an important factor in cystic cervicitis.

#### SYMPTOMS

*Leucorrhœa*.—Leucorrhœa is the most constant finding in cases of infection of the cervix. Often it is not the chief complaint, because many multiparous women do not consider it abnormal, since they are accustomed to its presence. Leucorrhœa usually exists if the patient complains

of lacerations, "ulcer of the womb" or pruritus. Cases in which leucorrhea has been considered the most prominent symptom have been grouped together.

Fifty-six patients treated by cauterization and thirty-four treated by amputation complained of leucorrhea; twelve treated by cauterization and seventeen by amputation complained of lacerations; seventeen treated by cauterization and ten by amputation complained of "ulcer of the womb," and six treated by cauterization and four treated by amputation complained of pruritus vulvae.

Although leucorrhea was the chief complaint in only 23 per cent of the cases in the entire series it was present in 51 per cent of the cases to a degree sufficient to lead the examining physician to grade it from 1 to 4 depending on the amount.

Leucorrhea, graded 1, was present in sixty-eight cases (18.6 per cent) in which cauterization was employed, and in forty (13.5 per cent) in which amputation was employed. Leucorrhea, graded 2, was present in seventy cases (19.2 per cent) in which cauterization was employed and in fifty-four (12.5 per cent) in which amputation was performed. Leucorrhea, graded 3, was present in forty-four (12 per cent) in which cauterization was employed and in thirty-seven (12.5 per cent) in which amputation was performed. Leucorrhea, graded 4, was present in eleven (3.1 per cent) of cases in which cauterization was employed and in six (2.2 per cent) in which amputation was performed. Leucorrhea, of any grade, was therefore present in 52.9 per cent of cases in which cauterization was employed and in 46.8 per cent of cases in which amputation was performed.

In a comparison of the two groups, it will be seen that leucorrhea was the complaint in a larger percentage of cases in which the cervix was cauterized. The difference is not great enough to be significant, or to lead to the conclusion that cauterization rather than amputation is indicated in any case of leucorrhea.

*Menstrual Disorders.*—The relation of menstrual disorders to cystic cervicitis is probably remote. Behny states that menorrhagia may be due to cervical infection and reports "cures" of menorrhagia in 63 per cent of a small series of cases after cauterization of the cervix. Miller believes that menstrual derangements are rather common as a result of secondary hyperplasia, circulatory stasis, and secondary ovarian involvement. In our series, the chief complaint in 24 per cent of the cases was referable to menstruation.

Thirty patients treated by cauterization and ten treated by amputation complained of menorrhagia; twenty-four treated by cauterization and eleven treated by amputation complained of metrorrhagia; thirteen treated by cauterization and seventeen treated by operation complained of irregular menses; fifteen treated by cauterization and fifteen treated

by amputation complained of "menstrual trouble," and fifteen treated by cauterization and eight treated by amputation complained of dysmenorrhea.

Although irregularities in menstruation were the chief complaint in only about one-fourth of the cases, a larger number of patients admitted deviations from normal when specifically questioned. More than one abnormality was present in some cases.

In eighty-five cases in which cauterization was employed and 112 in which amputation was performed (30 per cent) menstruation was normal; in 120 in which cauterization was employed and eighty-seven in which amputation was performed (31.4 per cent) menstruation was irregular; in 146 in which cauterization was employed and in seventy-one in which amputation was performed (32.7 per cent) menorrhagia was present; in fifty-nine in which cauterization was employed and twenty-one in which amputation was performed (12.21 per cent) metrorrhagia was present; and in eighty-two in which cauterization was performed and in sixty-two in which amputation was performed (21.8 per cent) dysmenorrhea was present.

*Pain.*—The normal cervix is insensitive to pain. However, it is often pain, real or imagined, which brings the patient for examination. Bilateral pelvic pain was complained of by fourteen patients treated by cauterization and eight treated by amputation; abdominal pain was complained of by twelve treated by cauterization and fourteen treated by amputation; pain in the right lower abdomen was complained of by fifteen treated by cauterization and twelve treated by amputation; pain in the left lower abdomen was complained of by sixteen treated by cauterization and thirteen treated by amputation; backache was complained of by thirty patients treated by cauterization and twenty-two treated by amputation; leg ache was complained of by five patients treated by cauterization and four treated by amputation, and dyspareunia was complained of by four treated by cauterization and five treated by amputation.

About one-fourth of the patients did not complain of pelvic disorders, but of general symptoms, such as nervousness, fatigue, stomach trouble, constipation, headache, neuritis, and heart trouble. In seventeen cases the cervix was cauterized and in thirteen it was amputated because of arthritis. Forty-five patients feared cancer or cancer had been diagnosed elsewhere.

Backache was a complaint in 18.4 per cent of the cases; in only a few cases was it the chief complaint. It was a complaint in 16.6 per cent of the series in which cautery was used and in 20.7 per cent of the series in which amputation was performed. Lynch states that backache, as a gynecologic symptom, is due chiefly to pelvic congestion and that slight defects in posture may favor its development. He reports

that 71 per cent of the women with marked vaginal relaxation aged less than forty complained of backache which was cured after operation in 79 per cent of the cases. In considering the prevalence of backache among women who have borne children, it does not seem logical to base the complaint on the condition of the cervix alone.

#### PATHOLOGIC OBSERVATIONS

All cervical tissue removed was examined microscopically. In most of the cases in which the cervix was cauterized, no specimen was removed unless there was suspicion of malignant disease. Two hundred eighty-three microscopic examinations were made in the 661 cases. The pathologic report in 187 (66.8 per cent) was cystic cervicitis, in seventy-seven (24 per cent), cystic cervicitis with erosion, in nine, hypertrophic cystic cervicitis, and in ten it was simply stated that the tissue was not malignant. In none of these cases was carcinoma found. In studying the pathologic reports of carcinoma of the cervix it was found that in only two cases had carcinoma been reported in a cystic cervix.

Cystic cervicitis is the condition resulting from laceration and subsequent infection or trauma from repeated infections. The embryologic development and the normal histology of the cervix explain why cyst is possible. Moench has recently discussed cervicitis from the standpoint of pathology, and explains cyst formation in detail. The cysts may be caused by inflammatory obstruction of the ducts of the cervical glands, or by the closure of these ducts by pressure from an inflammatory reaction, as erosions in the first stage of healing. They may also arise from glands whose ducts are covered by squamous epithelium in the second stage of healing of an erosion, or from islands of columnar or squamous-cell epithelium displaced or buried by trauma, usually resulting from lacerations of the cervix.

The point to be emphasized here is that cystic cervicitis is not a simple infection, inflammation, or erosion, but is a process in which these factors have persisted until the final stage of cyst formation is the result, and must be treated as such.

#### TREATMENT

The accompanying chart (Fig. 1) shows the number of cases treated each year by cautery and by amputation. It is interesting to note that since 1924 cautery has been the favored method. Various operations were carried out at the same time as amputation or cauterization of the cervix and they are listed in Table I.

In many cases the cervix was cauterized during the course of other more extensive operations, but these were not included in this study. The figures show that amputation of the cervix rather than cautery is used when another condition exists which requires operation. If



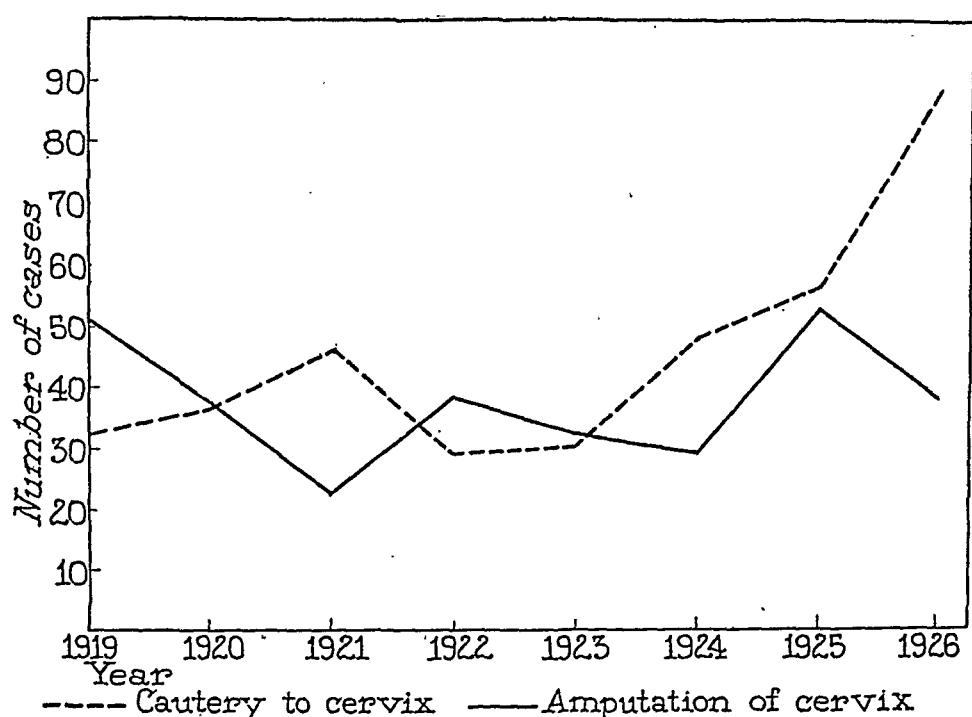


Fig. 1.

perineorrhaphy is indicated, the surgeon usually prefers to amputate a cervix which in itself could be treated either by thorough cauterization or by amputation.

In the majority of cases in which amputation is indicated, the Sturm-dorf type is advisable. At the Mayo Clinic amputation is seldom advised except for a patient near the age of the menopause or for one who does not anticipate pregnancy. The thorough cauterization indicated in this type of case is a different procedure from the linear cauterization so often recommended as treatment which can be carried out in the office. The patient must be thoroughly anesthetized or the operative field must be blocked off by parasacral or caudal anesthesia. All cysts are punctured and their walls thoroughly destroyed. If there is much hypertrophy of the cervix or if there is eversion of the endo-

TABLE I. SURGICAL PROCEDURES CARRIED OUT WITH AMPUTATION OR CAUTERIZATION OF THE CERVIX

	CAUTERIZATION		AMPUTATION	
	CASES	PER CENT	CASES	PER CENT
Cautery only	98	26.8		
Amputation only			91	30.9
Dilatation and curettage	175	48.0	72	24.4
Dilatation, curettage, and perineorrhaphy	22	6.0	28	9.1
Perineorrhaphy	27	7.4	100	34.0
Uterine suspension: internal	21		40	
Uterine suspension: external	6		5	
Bovee operation	0		17	
Removal of caruncle	1		1	
Excision of Bartholin gland cyst	3		1	
Repair of anal sphincter	2		3	
Plastic operation on vagina	3			

cervix, it is advisable to make about six deep punctures parallel to the cervical canal with the idea of destroying considerable tissue but not interfering extensively with the blood supply to the endocervix. For the first two weeks after this procedure the cervix looks ragged and sometimes there is considerable necrosis with a slight tendency to secondary hemorrhage. Within six weeks, however, the cervix will be contracted to less than normal size and somewhat shortened. The hypertrophied everted condition of the endocervix will have disappeared and the cervix will appear much the same as after low amputation.

#### IMMEDIATE RESULTS

Severe hemorrhage from the cauterized cervix enough to require a vaginal pack for control occurred in nine cases. In four cases the hemorrhage occurred on the twelfth day, in two on the thirteenth, in one on the sixteenth, and in two on the twentieth. There were six hemorrhages from the stump of the amputated cervix; in two cases the wound was resutured on the seventh day after operation, in two it was packed on the tenth day; in one of these cases hemorrhage was so severe that transfusion was required, and in two severe hemorrhages occurred three weeks after operation, after the patients had returned home.

The tendency to hemorrhage is slightly more marked after cautery, and it occurs from ten to fourteen days following the procedure. The slough which has formed separates, exposing the newly formed granulation tissue beneath. The bleeding is usually not more than spotting, but hemorrhage may occur, and for this reason the patient should be under observation for at least two weeks after cauterization. Hemorrhage may be controlled, as a rule, by a loose pack in the vault of the vagina but in case of free hemorrhage compression of the cervix by a tight vaginal pack or suture may be necessary.

Pelvic abscess occurred in three cases following cautery to the cervix, and in the same number after amputation. In each case there was a history of previous pelvic inflammation. In one case phlebitis followed amputation of the cervix.

#### RESULTS

The results are based on 227 replies to questionnaires, twenty-eight letters written previously by patients who did not reply to the questionnaire, and forty-five subsequent examinations.

*General Health.*—Fifty-three (33.5 per cent) of the patients treated by cauterization were entirely well, twenty-six (16.5 per cent) were improved and seventy-nine (50 per cent) were not well. Forty (28 per cent) of those treated by amputation were entirely well, eighteen (12.7 per cent) were improved and eighty-four (58 per cent) were not well. Many of these had complaints not referable to the pelvis. Seventy-two did not give the nature of their illnesses; three had general-

ized aches and pains, eight backache, five lower abdominal pain, nine fatigue and weakness, three stomach trouble, three bladder trouble, four nervousness, two rectal pain, one cardiac pain, two hay fever, and four insomnia. Those who were considered neurotic before the operation continued to complain afterward.

*Pelvic Condition.*—Many of those who were not perfectly well stated that the condition they complained of at the time of the treatment of the cervix was improved. Fifty-three patients treated by cauterization reported that the pelvic condition was definitely improved, eighteen that it was somewhat improved, and eighteen that it was no better. Forty-six patients treated by amputation reported that the pelvic condition was definitely improved, eleven that it was somewhat improved, and twelve that it was no better. Fewer patients on whom amputation of the cervix was performed considered themselves perfectly well, and fewer of them considered the condition they complained of improved.

*Leucorrhea.*—Leucorrhea is effectively eliminated by either cauterization or amputation of the cervix. The percentage of cures is slightly greater in cases in which the cervix was amputated, and there were fewer cases in which the leucorrhea returned. However, fewer of that group of patients complained of leucorrhea.

In the group of cases in which cauterization was employed, leucorrhea ceased in 101 (72.8 per cent), it was decreased in twenty-six (18.7 per cent), and was unchanged in twelve (8.6 per cent). In the group of cases in which amputation was performed, leucorrhea ceased in 107 (76.5 per cent), it was decreased in seven (5 per cent) and was unchanged in twenty-six (18.5 per cent). In twenty-four cases in which cauterization was employed and twelve cases in which amputation was performed leucorrhea returned less than three months after treatment. In four cases in which cauterization was performed and two cases in which amputation was performed leucorrhea returned in less than a year, and in nine cases in which cauterization was employed and fourteen cases in which amputation was performed, leucorrhea returned after a year.

*Menstrual Irregularities.*—Menstrual irregularities were not complained of in the letters received. In reply to a direct question in regard to irregular vaginal bleeding, six of those in the group in which cautery was used complained of a bloody vaginal discharge, and four of those in the group in which amputation was employed. In these cases hysterectomy had been performed since operation on the cervix but in none was a malignant lesion found.

Nine patients in each group remembered occasional intermenstrual bleeding at a previous time. Nine of the patients in the group in which cautery was used and twelve in the group in which amputation was performed had noted a premenstrual bloody discharge.

Menorrhagia can be assumed to have been the cause for the treatment by radium in the fourteen cases in which it was used subsequent to operation on the cervix. Dysmenorrhea was complained of in only two cases in each group following operation on the cervix.

*Subsequent Treatment to the Cervix.*—There were forty-five patients who wrote that they had received treatment at home subsequent to operation here. Following cautery, local treatment to the cervix was given in twelve cases, roentgen-ray treatment in two, radium in ten, chiropractic manipulations in two, hysterectomy was performed in two, myomectomy in one and ovariectomy in one. Following amputation local treatment was given at home in eight cases, radium in four, hysterectomy was performed in seven, and myomectomy in two, and only in these could the local condition of the cervix be investigated; forty-five returned for examination. Following cauterization a well-healed, normal appearing cervix was present in sixteen cases, local treatment was advised in twelve; suspicious areas removed for microscopic examination proved to be benign in two. Following amputation, the cervix was perfectly healed in five cases, cicatrices requiring dilatation were present in three, and the cervix was unhealed and required cauterization in four.

There is no report of carcinoma developing in any of these cases of cystic cervicitis, although seven years have elapsed since the first cases were treated, and more than a year since the last ones. These patients are at the age when carcinoma is most commonly diagnosed.

*Pregnancy.*—Sterility was the chief complaint in only eleven cases (3.2 per cent) in which cauterization was employed and in only four (1.4 per cent) in which amputation was performed. One woman bore two children after cautery for sterility, and another woman bore one child after amputation of an infected cervix which was considered the cause of her sterility. Both women believed that the operation made it possible for them to bear children. Since operation, there were four women in each group who still complained of sterility.

There were forty-six women who became pregnant, twenty-nine after cautery and seventeen after amputation of the cervix. Pregnancy occurs more frequently following cautery to the cervix than after

TABLE II. PREGNANCY AND LABOR FOLLOWING SURGICAL TREATMENT OF CYSTIC CERVICITIS

	CAUTERIZATION	AMPUTATION
Delivery without instruments or repair	17	3
Delivery with forceps, without repair	5	4
Delivery with instruments followed by repair	2	4
Now pregnant	2	1
Stillbirth	1	1
Twins	1	1
Cesarean section	0	2

amputation. Miscarriages are less frequent. Labor occurs normally in more cases, and repair is not necessary so often (Table II). Of the patients treated by cauterization eighteen later had children, and eight had miscarriages. In all, twenty-six children were born. Of the patients treated by amputation nine later had children and six had miscarriages. In all, thirteen children were born. Cesarean section was necessary in two cases after amputation of the cervix. In one case it was performed after test of labor; the mother had previously given birth to two children normally. In the other, twins were diagnosed in poor position. One patient whose cervix was cauterized gave birth to twins normally.

#### SUMMARY AND CONCLUSIONS

The incidence of cystic cervicitis is less than is usually reported, occurring in 2368 cases, or in 1.05 per cent of 226,900 women examined.

The symptoms presented as the chief complaint were leucorrhea (23 per cent), menstrual irregularities (23.4 per cent), pelvic pain (23.2 per cent), and irrelevant symptoms (30 per cent).

The indications for cautery or amputation of a hypertrophied, eroded, cystic cervix depend on the local condition of the cervix, and not on symptoms. Other things being equal, if other operations are to be carried out at the same time, amputation rather than thorough cauterization is advisable.

Cautery is as effective as amputation in the cure of leucorrhea.

The general health is not dependent on the cervical condition to any great extent.

Pregnancy occurs more frequently, miscarriages are less frequent, labor is more often normal and lacerations occur less frequently following thorough cauterization of the cervix than following amputation of the cervix.

There is no clinical evidence that cystic cervicitis in itself is a pre-cancerous condition.

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## THE CONTROL OF POSTOPERATIVE HEMORRHAGE FOLLOWING NEPHROTOMY FOR THE REMOVAL OF CALCULI\*

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NEPHROLITHOTOMY technic during my early experience in renal surgery, namely, that of incising the kidney longitudinally and removing calculi through the opening made, seemed so sanguinary and formidable with added risk of postoperative hemorrhage that I shrank when contemplating its performance. Ten years later (1901) when the roentgen rays were becoming an aid in determining and locating calculi, there came under my care a young girl with a definite shadow of a stone, about 2 by 1 cm. located in an upper calyx, and a second shadow, faint and small, located in the upper ureter. It was then that I conceived the idea, that by incising the upper ureter I could avoid hemorrhage, and through the opening made explore the kidney pelvis and upper ureter and remove all stones. After delivering the kidney and freeing the ureter from its cellular attachments to the renal vessels, an incision 2 cm. in length was made through the ureter near to and parallel with the crescentic curve of the kidney. On depressing the ureteral flap, access to the kidney pelvis and upper ureter through the ureteral opening was made easy. As vision was not obstructed by blood, both stones were easily found where located by roentgen examination and removed without difficulty. The crescentic incision was then closed with six interrupted very fine plain catgut sutures, and a provisional drain of narrow gauze was placed in the immediate vicinity of the ureteral incision. The operation was performed with surprising ease and no shock to the patient. Her convalescence was uninterrupted. The drain was removed after the third day with no evidence of urinary leakage. The wound healed elsewhere by primary union.

I continued to use this ureteropyelolithotomy technic until 1916 when there came under my care a patient with a large calculus in the pelvis of the left kidney, the largest I had ever attempted to remove in this manner. The ureteral opening was made supposedly big enough to accommodate the stone, but delivery through it occasioned an irregular tear of the ureteral wall which rendered repair difficult, resulting finally in urinary leakage and a persistent urinary fistula. The ultimate history of this case discouraged me regarding the ureteropyelolithotomy technic, for nephrectomy was eventually necessary to cure the patient.

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\*Read before the Surgical Section of the New York Academy of Medicine, February 4, 1923.

It might be said in passing that while this failure discouraged me in continuing the use of the ureteral route for the removal of kidney calculi located in the kidney pelvis, it should not have done so, but should have served only as a lesson to help me determine the kind of case in which ureterotomy for the removal of renal calculi is not indicated. However, because of this unhappy experience, my attention was directed to the development of a safer technic than that commonly adopted in removing renal calculi through a longitudinal incision of the kidney structure.

The features of the technic to be described and to which discussion is particularly directed, pertain especially to the closure of the renal incision and to the encircling removable sutures to be tightened, should occasion demand it, to ensure hemostasis.

The initial approach to the kidney through the lumbar region varied from that I formerly used, but only in respect to the fascial incision in the upper triangle. I now prefer to begin the incision of this fascia below the last dorsal nerve instead of above it, as by so doing there is less liability of injuring the nerve when extending the incision downward.

On delivering the kidney, the ureter was freed from its cellular attachment to the renal vessels, and one of the blades of a rubber ring forceps protected with rubber was passed between the freed ureter and vessels, and moderate compression made on the vessels (*a*, Fig. 1). When the median longitudinal incision was made through the kidney structure, pressure of the forceps was increased as found necessary to control hemorrhage. Care was taken not to crush the vessels to the degree of traumatizing their walls. The use of the fingers for the use of controlling the blood supply to the kidney when operating, is perhaps preferable to the forceps, but they tire quickly and the hand crowds the field of work.

With the kidney delivered and the vessels compressed a median longitudinal incision is made through it. The position and approximate size of the stone is determined by the finger or instrument passed into the pelvis, and the pelvic opening enlarged as found necessary to accomplish the delivery without tissue injury.

Before incising the kidney, care should be taken to protect the wound by placing gauze around the organ. After delivering the stone, irrigation of the pelvis is advisable.

Instead of a blunt needle which produces an unnecessary amount of trauma of the friable kidney structure and leaves a canal through which bleeding may occur, I prefer to use a comparatively small cambric needle threaded with No. 0 chromic catgut. The suture is doubled so that the small hole made by the cambric needle will be completely filled by the two strands of catgut which follow it (*c*, Fig. 1). The needle is passed through the kidney structure on a plane with the cut edges of the kidney pelvis incision and repassed on the same plane in the opposite direction so as to form a loop (*b*, Fig. 1); the number of these sets of sutures depends upon the length of the kidney incision, but four or five are usually sufficient to hold in close and exact approximation the incised surfaces. (Fig. 2.)

The securing of these double looped sutures may be made in either of the following ways: First, the needle end of the double suture after its final emergence is passed through the double loop on the opposite kidney surface and tied to the free ends over the convex border (*a*, Fig. 2). Second, the needle is first cut from its doubled suture and one of these several sutures is tied as a mattress suture while its companion single suture is dealt with in the same manner as are the double sutures

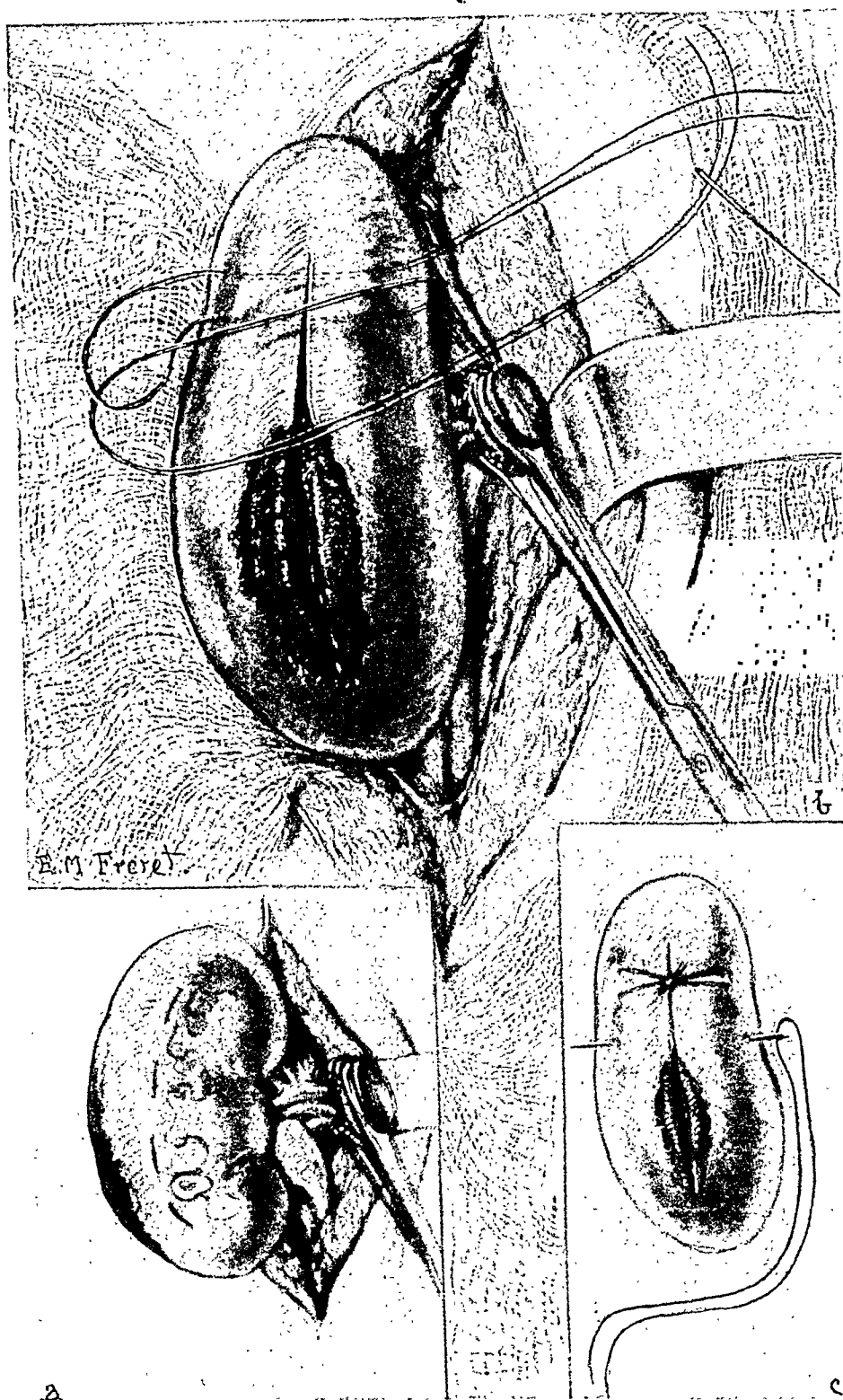


Fig. 1.—*a*, Shows kidney delivered, ureter and vessels freed, vessels compressed; marks on kidney surface indicate upper limits of kidney pelvis on which plane the catgut sutures are passed. *b*, Median longitudinal incision through traumatized area. The double suture passed through the structure of kidney, the needle end passed through double loop, and double suture tied over kidney. *c*, Double suture tied over kidney border; second set of sutures being passed.



in the first method (*a* and *b*, Fig. 2). The latter method is preferred if an artery of considerable size has been encountered, as hemostasis is then best secured with this mattress suture in combination with a suture passed through the loop and tied over the convex border in sufficient number to adjust the cut edges of the wound. (Fig. 3.)

Two B & B silk sutures, removable encircling sutures which insure hemostasis, are now passed completely around the kidney, one just above the upper and the other just below the lower limits of the hilum. To prevent these sutures from

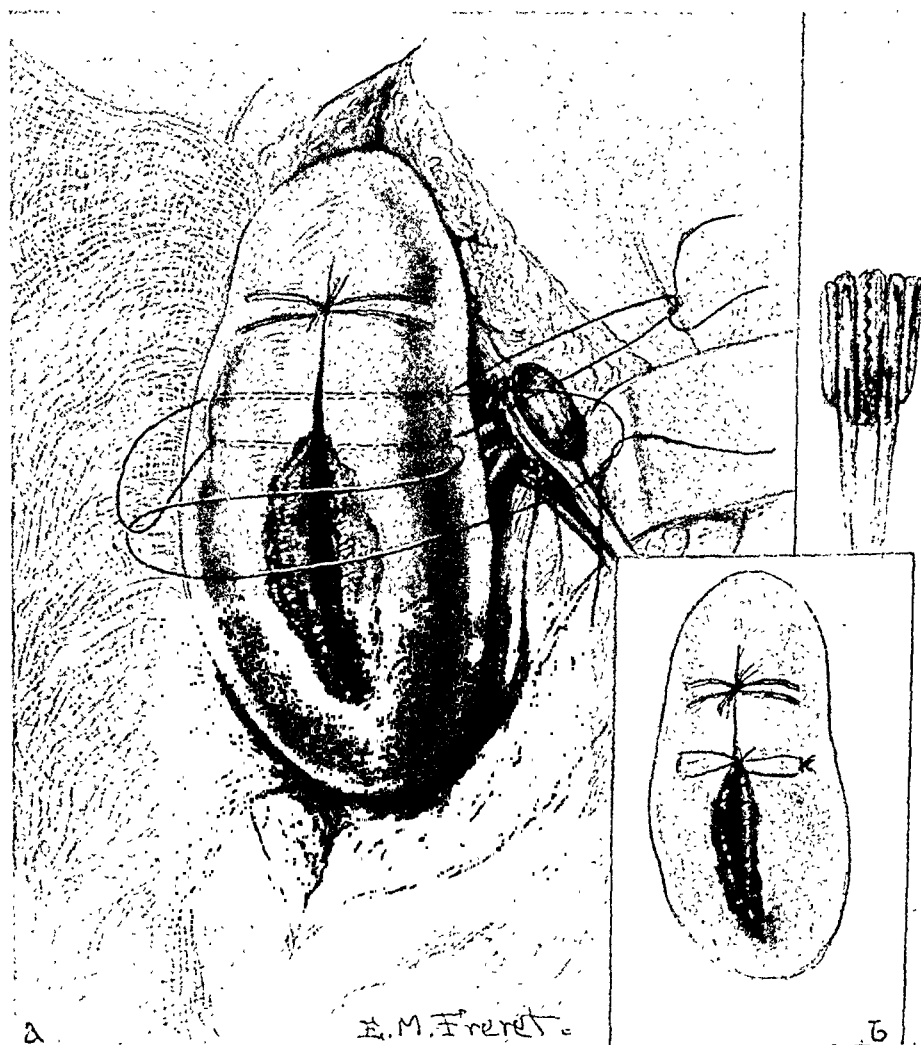


Fig. 2.—*a*, Second set of sutures passed; one of these sutures is being tied as a mattress suture, while its companion suture is dealt with in the same manner as the double sutures in *c* of the first illustration; *b*, shows the single mattress suture tied, and the single loop suture tied over kidney border.

losing their positions, they are made to penetrate superficially the anterior and posterior surfaces of the kidney, but only deep enough to secure an anchorage to the fibrous capsule. (Fig. 4.)

After releasing the rubber ring forceps and returning the kidney to its bed, the free ends of these sutures are made to pass through all of the tissues on one side and then on the other of the lumbar incision, and each set tied in a bow knot over a bolster of iodoform gauze. Should secondary hemorrhage occur, tightening of these sutures will insure hemostasis.

The following case is reported because its postoperative history demonstrates the value of the technic herein advocated.

Mrs. A. P., aged forty-four; height 5 feet; weight 99 pounds, entered the Woman's Hospital January 25, 1926 for the relief of vesical pain and difficulty in

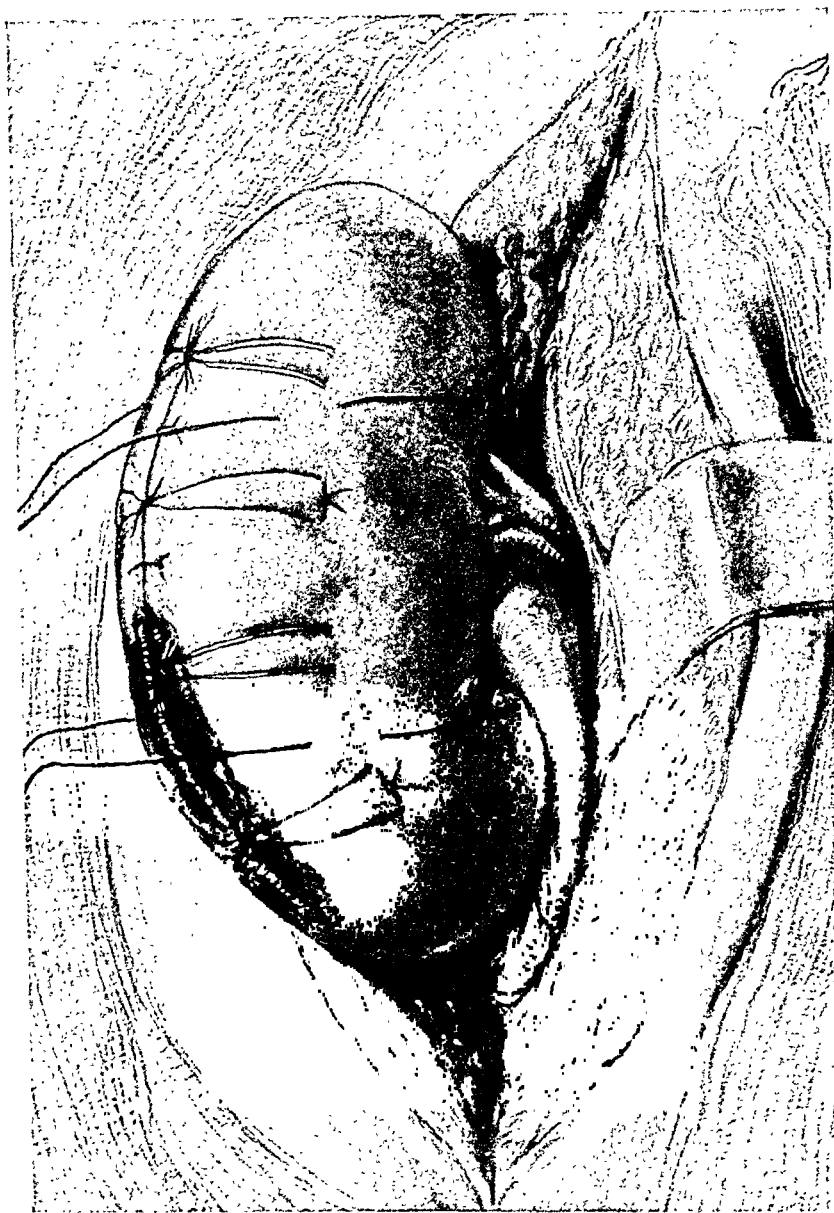


Fig. 3.—Showing all the penetrating sutures in position and tied with two superficial stitches adjusting line of incision, as well as two encircling silk sutures, the free ends of which are passed through the fascia muscles after the kidney has been replaced.

voiding urine. Symptoms were of ten years duration. The urine showed albumin, many red blood cells and triple phosphate crystals. The x-ray showed a dumb-bell shaped stone in the lower pole of the left kidney. (Fig. 5.)

In the left lumbar region there existed a large depressed scar, the result of an operation done in 1913 for the removal of three stones from the left kidney. Part of the technic used then according to information received by letter of inquiry, was

the placing of a rubber drainage tube\* through the kidney structure into the kidney pelvis to insure direct drainage and irrigation of the pelvis.

*Operation.*—A large mass of scar tissue was found in the line of incision; great difficulty was met in freeing the kidney, especially the lower pole, because of its firm attachment to the lumbar tissues, as the result of damage inflicted at the previous operation. In order to free this pole, a considerable area of the kidney surface was necessarily severely traumatized. After delivering the kidney, the

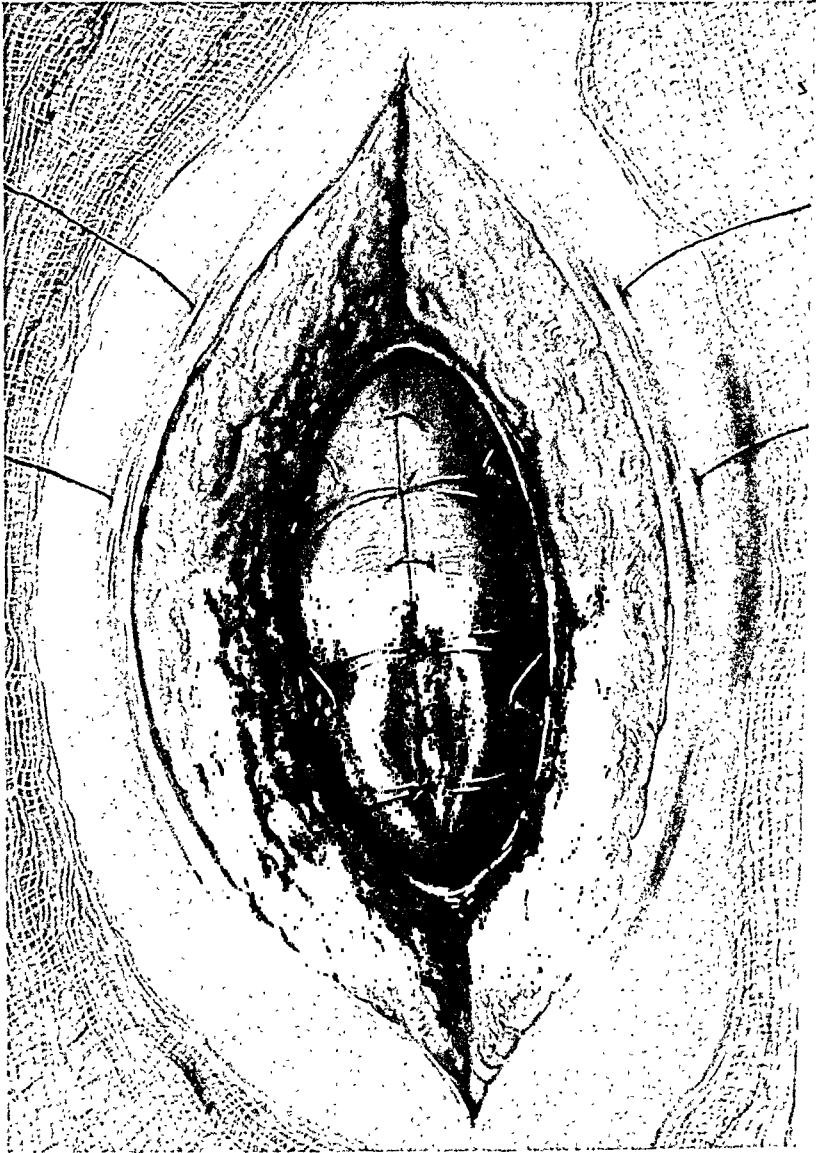


Fig. 4.—Shows free ends of encircling silk sutures passed through abdominal wall and kidney partly replaced for illustrative purpose.

renal vessels and the upper ureter were freed from their surrounding tissues to the hilum and then freed from each other. The isolated renal vessels were then grasped by a rubber ring forceps passed between the freed ureter and the vessels and a median longitudinal incision made through the kidney into the kidney pelvis, the

\*This fact accounts for the difficulty encountered on reopening and as the area of direct drainage was the area of fixation and immediate postoperative bleeding. It must have also borne a causative relationship to the hemorrhage which followed several days postoperative.

stone located and extracted with light forceps and the pelvis irrigated with salt solution, gauze being previously arranged about the kidney to protect the wound.

A cambric needle large enough to accommodate No. 0 catgut and threaded with this as a double suture, ends not tied, was made to penetrate the kidney substance on a plane parallel to the cut edges of the kidney pelvis. The needle was then re-



Fig. 5.—Showing stone in lower pole of an elevated and fixed left kidney from which three stones had been previously removed.

entered at a point less than one-half cm. from its exit and made to again penetrate the kidney on the same plane and emerge at a point about one-half cm. from its original entrance. Four of these sets of sutures were passed through the double loops on the opposite surface and tied to the free ends over the convex border. To adjust the cut edges of the kidney incision several interrupted catgut sutures were used at intervals. Two encircling removable sutures of B & B silk were used as previously described. A rubber tissue drain was placed in the region of the lower pole.

*Postoperative History.*—A small amount of blood was found in the urine during the first twenty-four hours after operation but none was again noted until the fifth day. This was accompanied by severe pain in the left lumbar region. Bloody urine continued four days. No bleeding was observed from the lumbar incision when dressed on the seventh day, but some was noted on the eighth day, a very considerable amount of blood was passed in the urine on the ninth day, bleeding also noted from the wound. Calcium chloride 15 gr. was given intravenously, also calcium lactate 5 gr. three times a day by mouth. Bleeding was checked for eighteen hours, seemingly as the result of this treatment; it then reoccurred in urine and lumbar wound and continued in considerable quantity for two days in spite of the continued use of calcium lactate by mouth and a second intravenous injection of calcium chloride. On the thirteenth day the small cigarette drain was completely removed and the lower B & B silk sustaining suture which encircled the lower pole was untied and retied tightly over a fresh bolster of gauze. Bleeding at once ceased and did not recur.

As the calcium salts were given a fair trial but failed to permanently check the hemorrhage and as the steadily increasing hemorrhage was immediately and permanently checked both internally and externally by tightening the B & B silk suture encircling the lower pole, the value of the removable encircling sutures under these circumstances would seem demonstrated.

*Follow-up.*—Patient was last seen October 22, 1926. She was relieved of all symptoms of which she complained on entering the Hospital and had gained twenty pounds. At times she has had discomfort in the region of the right kidney and along its ureteral tract. *Examination* showed that the right kidney had descended considerably but the left kidney was in normal position.

#### CONCLUSIONS

1. The removable encircling sutures can be placed without danger and their presence in no way injures the kidney structure, as is proved by the many operations for suspending the kidney I have done with success, using the removable encircling suture as here described.

2. These sutures should be so adjusted over a piece of gauze as to permit one or both being tightened at any time as necessity demands.

3. As the lower suture was not tightened until other practical means had been tried and failed, the value of the encircling suture would seem demonstrated in cases of postoperative renal hemorrhage.

## REPORT OF THREE CASES OF STRUMA OVARIII

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(From the Pathological Department of the Jewish Hospital)

IN THE routine examination of dermoid cysts of the ovary, thyroid tissue is found as one of the tissues usually encountered. It occurs more regularly, however, as the preponderant or sole constituent of a teratomatous ovarian tumor.<sup>1</sup>

Gottschalk<sup>2</sup> in 1902 first reported an ovarian tumor containing hyperplastic thyroid tissue as its main component. Since then 46 cases have been added to the literature. Up to 1909, when Frank<sup>3</sup> described the first case in this country, 12 cases had been reported. In 1918 Adolph<sup>4</sup> collected 40 cases from the literature and recorded two more of his own. Since then only 5 additional cases have been described, not including the two mentioned in this paper.

Gottschalk<sup>2</sup> named his case "folliculoma malignum ovarii," because he believed the cells to have been derived from those of the graafian follicles. Kretschmar<sup>5</sup> and Pick,<sup>6</sup> however, recognized in this neoplasm a morphologic similarity to colloid goiter or struma. Since Pick's analysis, struma ovarii has been regarded as a teratomatous growth rather than as a metastasis from a thyroid gland, normal or abnormal. Unanimity has not yet been reached on this aspect of the matter. When in 1901 Oderfeld<sup>7</sup> found a thyroid tissue deposit in the jaw, and Steinhaus<sup>7</sup> one in the frontal bone, Kretschmar<sup>5</sup> advanced the theory of metastasis. But Pick<sup>6</sup> in analyzing a series of 21 dermoid cysts found thyroid tissue in 6 of them. Saxer<sup>8</sup> discovered a tooth, and Meyer<sup>9</sup> the lens of an eye, embedded in otherwise normal ovaries. Hence, Pick deduced that since single highly-specialized structures may be the only sign of a teratomatous growth, and as thyroid gland metastasizes almost always to the bones, it was not likely that the ovary would, in so many cases, be the sole seat of such a deposit. The majority of opinions has it that the other components of the teratoma are overgrown by the thyroid elements, their disappearance resulting. The occurrence of thyroid tissue growing close to respiratory anlage in such cases is not uncommon.<sup>1</sup>

As the number of cases of struma ovarii in the literature is still small, and the clinical data associated with them so sparse, the following three cases are being reported.

CASE 1.—M. K., a woman fifty years of age, entered the Jewish Hospital on October 3, 1926, complaining of nausea, heartburn, epigastric postcibal distress, constipation, and loss of weight. Her family history was negative save that her father had died of gastric carcinoma. Her own previous history is irrelevant. Her menses had their onset at thirteen years, and after a normal menstrual life the menopause set in recently. She is married and has had four normal gestations and one abortion. The complaints on admission were all, except for the loss of weight, referable to the upper gastrointestinal tract, and had persisted for some time. The loss in weight was recent and slight. Apart from these symptoms, a severe left upper abdominal pain had made its appearance about two weeks before entrance to the Hospital and after lasting several days disappeared, with no recurrence.

*Physical Examination.*—Pulse, on admission, 84; temperature 100; respirations 20. An obese, florid female with no noteworthy features save the abdominal findings. A mass about the size of a large grapefruit was felt in the lower left abdomen, close to the midline. It was firm, ballottable, and tender. The blood pressure was 145/70. The blood count and urine examinations were normal. On opening the abdomen a quantity of serous fluid escaped. A tumor the size of a man's fist occupied the greater part of the left ovary. The right ovary was normal. After a left oöphorectomy had been performed the abdomen was closed. Recovery was uneventful.

Macroscopic examination of the specimen revealed a solid mass 8.5 by 7 by 4 cm. to which was attached a cyst. The mass was soft in consistency, and its surface was pearly white, with no excreescences. At one point there was a ruptured cyst. On section, the capsule was found to be thick. Near one pole there was a

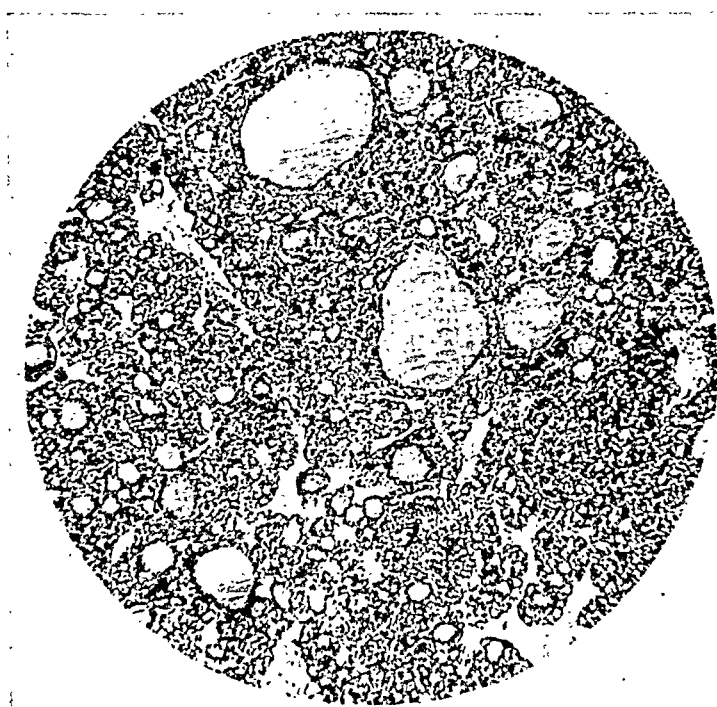


Fig. 1.

grayish-pink mass 2.5 cm. in diameter. The remainder was made up of soft reddish-brown tissue. This contained a core of solid material from which there was a radiating structure. Near the capsule there was a deposit of ochre-colored pigment which, on microscopic examination was found to be composed largely of typical hyperplastic thyroid tissue. The alveoli were filled with colloid and were surrounded by myxomatous tissue.

CASE 2.—A. B., aged thirty-four years, entered the Jewish Hospital August 13, 1927. Her mother had died at 66 of uterine carcinoma. Her menstrual onset was at twelve years and occurs every twenty-one to twenty-four days, lasting five to six days with moderate premenstrual pain. She had been pregnant three times, one pregnancy terminating in an abortion and being complicated by phlebitis. Her complaint consisted of pain in the right lower abdominal quadrant eight days before admission, subsiding spontaneously and recurring. The pain was not accompanied by nausea or vomiting.

*Physical Examination.*—Pulse, on admission, 120, temperature 101, respirations 20. Only the abdominal findings presented features worthy of note. These were tenderness over McBurney's point and positive tenderness on Murphy percussion over the right side posteriorly. The urine was negative. Blood count showed 16,000 white corpuscles, of which 70 per cent were polymorphonuclear leucocytes.

At operation the appendix was found to be inflamed and were removed. At the same time an ovarian cyst on the same side was resected. The cyst measured 6 cm. in diameter. Half its internal surface was grayish-white, smooth and glistening, while the other half was brownish-pink. The external surface was grayish-pink. The cyst wall was 1 mm. thick. One side of the cyst presented an encapsulated cystic nodule 1.2 by 2 cm., irregular and hard. Its section showed a grayish-yellow, glistening surface. The ovarian mass adjacent to the cyst measured 5 by 3 cm. It was soft in consistency and yellowish-pink in color. On section, its

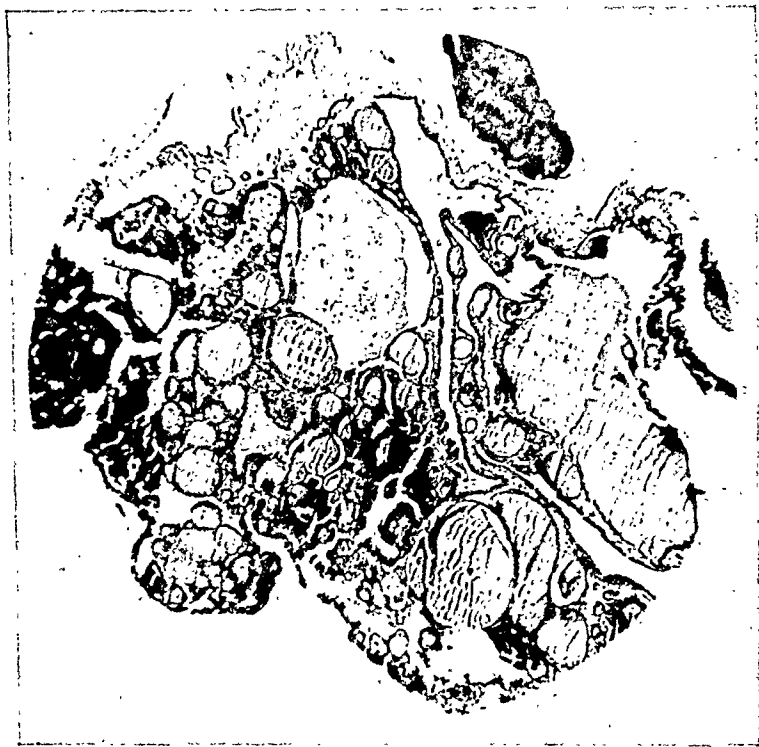


Fig. 2.

surface was rough and yellowish-gray. A corpus hemorrhagicum encountered measured 1.5 cm. in diameter. Microscopically the appearance of the characteristic areas was that of hyperplastic thyroid tissue, as in Case 1, but with the acini more markedly distended with colloid. In addition there were present other characteristics of a dermoid cyst, with which, in this case, the struma was associated; viz., skin, sweat and sebaceous glands, all lodged near the thyroid tissue.

CASE 3.—B. E., aged thirty-four years, was admitted to the Hospital February 15, 1928. She complained of attacks of cramp-like pain in the right lower quadrant. Her family history was irrelevant, with the exception that of her four sisters two had been operated on for fibroids of the uterus. She was married six and one-half years and had one child, two years and ten months old. Her history states that ten weeks after her childbirth a fibroid was discovered, but it gave her no untoward symptoms. For the past year and one-half she suffered from repeated attacks of sudden pains, either cramp-like or sticking, situated usually in the right



iliac quadrant, but they were occasionally felt all over the midabdomen. The pains were frequently accompanied by nausea or vomiting. Radiation of the pain occurred occasionally toward the back, and she often had a feeling of fullness in the rectum and then defecated frequently. Some of her attacks lasted as long as ten hours. Relief was obtained by the application of heat to the abdomen.

*Physical Examination.*—Pulse, on admission, 102, temperature, 100.2°, respirations 30. There were no points in the examination to engage the attention, except that there was tenderness elicited on deep palpation of the abdomen to the right of the umbilicus. There was a suggestion of a mass felt below the umbilicus, but nothing definite could be made out, except that it seemed to have its origin in the right iliac fossa. On vaginal examination the cervix uteri and the corpus were essentially negative, but a tense, tender mass the size of a small grapefruit was felt arising from the pelvis and projecting into the right iliac fossa. The left

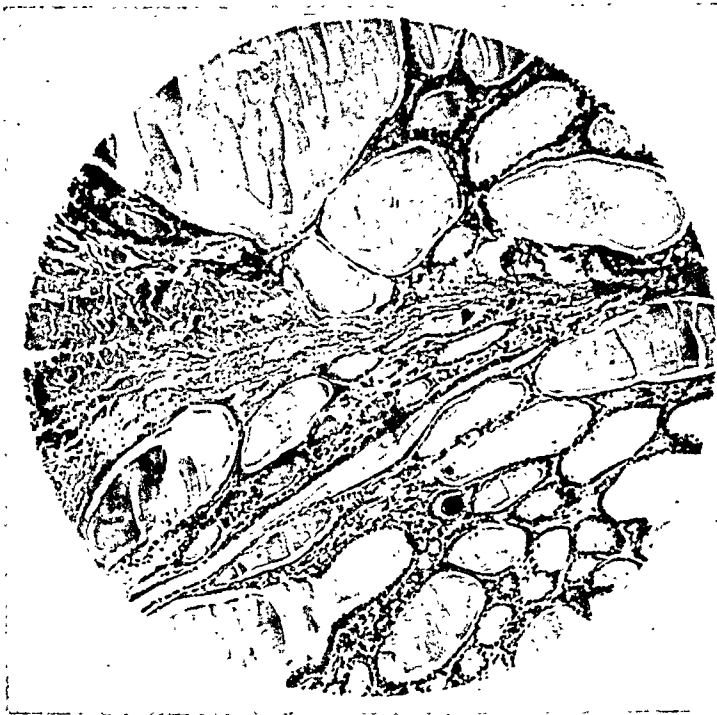


Fig. 3.

fornix was negative. A blood count showed 10,200 leucocytes, of which 56 were polymorphonuclears and 44 per cent lymphocytes; hemoglobin 85 per cent. Her blood pressure on admission was 95/65.

On operation the uterus was found to be normal in size and position, and was freely movable with several scattered fibroids. The right ovary had a multilocular cyst, twisted one and one-half times. The peritoneal cavity contained much fluid of a serous character. The appendix was atrophic, and the left ovary was cystic and had a corpus luteum. A right salpingo-oophorectomy was done. The temperature fell to normal on the second day postoperative, the respirations to 20, and the pulse to 80.

Macroscopic examination showed a mass in the parovarium 5 cm. in diameter, consisting of numerous cysts, large and small. On section, some of the cysts were found to be lined by a smooth membrane. Others had cystic projections and bone deposits. One portion showed soft brown tissue, from which a gelatinous sub-

stance could be expressed. This tissue resembled thyroid, while other areas contained sebaceous material. On microscopic examination, the main structure of the solid portion of the cyst was seen to consist of typical thyroid tissue, as shown in the microphotograph, in a state of hyperplasia.

In reviewing the literature, the clinical facts to be deduced are meager. The youngest patient reported was twenty-two years, the oldest, fifty-seven years old. Some were nulliparous, others had borne children.

The usual size of the tumor varies from that of a peach to that of a man's fist or a child's head. Ascites was present in about half of the cases. In only two cases was there a coincidental goiter of the neck. Kovács' case<sup>10</sup> had symptoms of exophthalmic goiter which subsided on removal of the ovarian tumor which morphologically and chemically was thyroid tissue. Kretschmar's case died of metastases, but none of the others seem to have had any complications from the neoplasm.

When the struma ovarii is part of the dermoid cyst, one will, of course, find the other characteristic structures of this genus of neoplasm, skin, hair, sebaceous and sweat glands,<sup>11, 12, 13</sup> brain and nerve tissue, bone,<sup>4, 8, 14</sup> salivary glands,<sup>12</sup> cartilage,<sup>13</sup> intestine,<sup>9</sup> teeth,<sup>2</sup> in any manner of combination of some or all of these. But the predominating picture is the thyroid tissue, which may occur in the fetal or the colloid form and in which the cyst-like acini may be enormously distended. In 11 cases thyroid tissue was the only structure present.<sup>1, 10, 15, 16, 17, 18, 19, 20, 21</sup> In some specimens the proliferating cells have in spots not yet assumed the characteristic thyroid structure and in some cases greatly resemble the tumors variously described as folliculomas, oöphoromas, and granulosa-cell tumors.

Rohdenburg<sup>22</sup> in classifying a series of 500 ovarian tumors encountered in the examination of 2691 ovaries, found 61 dermoid cysts and teratomas. Eighteen were pure dermoids in which thyroid tissue was encountered in 9 specimens. Accompanying a fibroma in one case there was a struma ovarii.

It has been mentioned above that several parts of our specimen in Case 1 resemble microscopically folliculoma ovarii, to which group Gottschalk assigned his tumor. Proescher and Roddy<sup>23</sup> say there is no similarity, and that Gottschalk was misled by the cystic degeneration of some of the alveoli into thinking that they arose from the follicle cells, and that the fluid in the midst of these cell groups was liquor folliculi. Often the accompanying picture is confusing. Thus Kretschmar believed his tumor to be an endothelial one, since, as Proescher and Roddy remark, "an adenomatous endothelioma, at a glance, resembles thyroid tissue."<sup>23</sup>

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## PREGNANCY FOLLOWING THE DEMONSTRATION OF THE CLOSURE OF BOTH TUBES BY HYSTEROSALPINGOGRAPHY

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IN THE January *Bulletin de la Société d'obstétrique et de gynécologie de Paris* (xvii, 25) Mme. Francillon-Lobre and M. Dalsacé report two cases in which pregnancy followed shortly after the demonstration of the patency of at least one tube by the injection of lipiodol. The authors report these cases for three reasons: (1) because no such cases have been previously reported in France, (2) because it had been argued that lipiodol might have a harmful effect upon spermatozoa and ova, (3) because both young women had exhausted all therapeutic measures both medical and surgical for sterility. In the discussion M. Douay reported a case similar to these, except that the patency of the tubes remained in doubt even after the lipiodol injection. We wish to report a case in which the tubes were demonstrated to be closed both by the Rubin test and by hysterosalpingography, and in which pregnancy followed without any treatment whatever. This case is interesting in that it shows the folly of making dogmatic statements in dealing with cases of this kind.

Mrs. M., aged thirty-five, consulted one of us on June 15, 1926. She was married in January, 1918, and had never been pregnant. She began to menstruate at 12 years, and was regular every four weeks. The flow lasted five days and was accompanied by pain the first two days. The patient had a leucorrhea of many years' duration. She had had some pain in the right side of her

abdomen since 1920. Otherwise she felt well except for a soreness in her breasts every 28 days. She gave the history of having had typhoid fever and the following operations: a nasal operation in 1916, tonsillectomy in 1920, and the insertion of a stem pessary in 1922.

The patient was five feet five inches tall and weighed  $123\frac{1}{4}$  pounds. Examination was negative with the exception of a cervicitis and a basal metabolic rate of -16. The cervix was treated and she was put upon thyroid treatment. Her dysmenorrhea disappeared and in July the metabolic rate was -2. In April, 1927, the patient returned. She had continued the thyroid treatment under the direction of her home doctor for nine months. On May 5, 1927, we inflated her tubes, but no gas entered under 200 mm. of Hg. pressure. We then



Fig. 1.—Roentgenogram after injection of the uterus and tubes with iodized oil. Arrows indicate closed fimbriated extremities.

gave her  $\frac{1}{6}$  gr. of morphine and  $\frac{1}{150}$  gr. of atropine and injected the uterus with iodized oil. Both tubes filled to their fimbriated extremities, but none entered the peritoneal cavity. The patient was advised that an operation offered a good chance of relieving her condition. She planned to come back in the fall for the operation, but sickness in her husband's family and one thing and another made her put off coming back to Richmond. On February 22, 1928, she again consulted one of us, not having menstruated since October 14. There was an abdominal tumor extending from the symphysis to the navel and unmistakable fetal heart sounds and fetal movements.\*

MEDICAL ARTS BUILDING.

\*The patient was delivered of a 7½ pound girl, July 18, 1928.

## PRIMARY BILATERAL CARCINOMA OF THE TUBE\*

BY SAMUEL A. WOLFE, M.D., BROOKLYN, N. Y.

(From the Departments of Gynecology and Pathology, Long Island College Hospital)

THE first case of carcinoma of the tube was positively demonstrated and described by Orthman in 1886. Since then the number of reported cases has increased so that in 1910, Doran could collect one hundred cases from the literature. At the present time about two hundred authentic cases are recorded. Sanger and Barth emphasize the presence of chronic inflammation as a predisposing factor in carcinoma of the tube. Doran and Fearn's trace cases of carcinoma of the tube to malignant degeneration in benign papilloma. The disease generally appears in women in the fourth and fifth decade of life, although Norris has reported a case in a patient twenty-seven years of age.

*Pathology.*—Primary carcinoma of the tube in the majority of instances is unilateral. Bilateral cases are not infrequent, and Sanger reported three such cases in a series of twelve. Thirty per cent of all reported cases present bilateral tumors. The size of the tumor is extremely varied and ranges from a small papillary excrescence to that of a fetal head. The lateral third of the tube is the seat of choice and is accordingly dilated by the contained tumor tissue. The external tube surface is smooth or in late cases presents a network of fine papillary excrescences. On section of the tube in early cases, the mucosa is studded with numerous, fine, papillary growths. In advanced cases the tube lumen is almost completely filled with tumor tissue, but solitary masses are still recognizable. In about half the cases, the abdominal ostium is obscured due to adhesions. In some instances papillary excrescences project from the dilated abdominal ostium.

*Microscopically.*—These tumors universally retain the papillary type, but late cases present both papillary and alveolar formations. The pure papillary type presents a central fibrous core usually supporting only a single lining epithelial layer. In the second form the layers are frequently multiple and have lost their cell alignment. Solid alveolar clusters are reproduced and extend into the musculature of the tube. Growth accordingly is faster and more diffuse and excrescences appear externally. The component cells in both forms, are cylindrical or cuboidal in form; and are free from ciliated processes. The nuclei are large, vesicular but irregularly located and present marked variation in size, form, and staining capacity.

\*Read before the Brooklyn Gynecological Society, April, 1928.

*Complications.*—The purely papillary form generally is circumscribed and remains in the lumen of the tube but may produce metastasis by the lymphatic or vascular channels. The papillo-alveolar form in addition penetrates the tube to reach the peritoneal coat resulting in malignant implantation throughout the peritoneal cavity. In both types metastasis to the ovary, uterus, and retroperitoneal glands occurs. Stultz encountered seven cases of lymph node metastasis in forty-three reported cases. The following case report will illustrate the clinical and pathologic features of bilateral carcinoma of the tube.

Mrs. M. K., aged fifty-six, was admitted to the Medical service of Dr. Luther F. Warren, December 5, 1927, complaining of vaginal discharge, pain and swelling in the abdomen, and loss of weight. Family history was irrelevant. Previous medical history was essentially negative except for pyelitis at the age of twenty-eight. At the age of twenty a fibroid tumor was removed. Menstruation began at the age of fifteen, recurred every twenty-eight days and lasted for three to four



Fig. 1.—Right Tube: The organ has been sectioned to expose the interior. The ampullar and infundibular portions of the tube present papillary excrescences and tuberos tumor masses. Tumor tissue can be traced to the isthmus zone.

days. Menopause occurred at the age of forty-six. Patient was first married at the age of eighteen, husband died four years later of diabetes. The patient remarried at the age of forty-eight; husband died three years later of pulmonary tuberculosis. Patient had one child with the first husband thirty-four years ago; pregnancy, labor, and puerperium were normal.

*Present Illness.*—A vaginal discharge was first noticed by the patient two years ago which was moderate in amount, markedly foul, and pale pink in coloration. Four weeks prior to admission it spontaneously disappeared. At this time enlargement of the abdomen was first noticed. This has been progressive, particularly marked in the lower abdomen, and associated with pain in the right side radiating to the right lumbar region. The pain was burning in type and intermittent in character. It was not related to meals and not relieved by medication. Since onset, the patient has been incapacitated due to a feeling of weakness. Her weight has progressively diminished from 147 pounds, one year ago, to 125 pounds at the time of admission to hospital.

*Physical Examination.*—Patient had a general anemia. Head, neck, and thorax were essentially negative. Abdomen was markedly distended, dullness present in the flanks; a fluid wave was elicited. The liver was palpable. Pelvic examination

revealed a marital introitus. Anterior and posterior vaginal walls normal. Cervix was small, lacerated and slightly limited in motion. The uterus as such could not be sharply defined because of the marked abdominal distension. An irregular mass was present in the right lateral fornix. Laboratory data: Red blood cells 4,250,000, Hb. 70 per cent, white blood count 7,000, neutrophils 68 per cent, blood pressure 140/50, urine normal, blood chemistry normal, blood Wassermann four-plus. In spite of abdominal paracentesis and general supportive treatment the patient gradually failed and died on January 3, 1928.

Autopsy was performed January 4, 1928, by Dr. J. Arnold de Veer. "The body is that of an elderly female greatly emaciated. The peritoneal cavity contains about a liter of serofibrinous blood-stained fluid. Both pleural cavities contain a small amount of clear fluid. The lungs are free from exudate and are edematous posteriorly but otherwise normal; there is no exudate in the pericardial cavity. There are no pericardial adhesions. The heart is normal in size. The



Fig. 2.—Microscopic section of right tube: The papillary excrescences grossly noted are presented by papillary carcinoma. Note the multiple cell layers. The musculature is edematous. (x80.)

musculature is firm. The aorta is markedly atheromatous. The aortic cusps are widely separated at the commissures. The remaining valves are normal. All of the abdominal viscera are covered by recent fibrinous adhesions. The spleen is normal in size and consistency. On section it shows moderate fibrosis. The liver is large, pale and softer than normal. On section it presents congestion and fatty degeneration. The gall bladder contains a solitary gallstone measuring 1.5 by 2.5 cm. The capsules of the kidneys strip readily but leaves coarsely granular cortex. They are normal in size and the markings are fairly well preserved. Gastrointestinal tract presents no special changes. The omentum extends down into the pelvis and is filled with metastatic nodules of carcinoma. The sigmoid is surrounded by carcinoma but its luteum is free from involvement."

The pelvic viscera were removed en masse and referred to the gynecologic laboratory for examination. Uterus: The organ is most densely covered with papillary

malignant tissue which covers the anterior and fundal portions of the organ; posteriorly the serosa is smooth and shiny. The organ measures 7 cm. in length from fundus to external os, 5 cm. transversely at the level of the round ligaments and 2 cm. in the anteroposterior diameter. The squamous lining of the portio is normal. The os is patent. On incision the uterine cavity is regular. The endocervical mucosa is atrophic but several of the arborae vitae are retained. The lining of the body and fundus is smooth and atrophic. The myometrium is thin, atrophic and fibrous and measures 10 mm. in the cervical area, 8 mm. in the body and fundus. The vessels in the vascular zone are sclerotic. The serosa has been largely replaced by tumor tissue previously noted. Extension into the underlying muscle however is not distinctly recognizable on gross examination. Microscopically: The endometrium presents typical senile atrophy. The myometrium is comprised of small muscle fasciculi comprised of atrophic muscle fibers. The connective tissue septa are prominent. These changes are dependent upon sclerosis

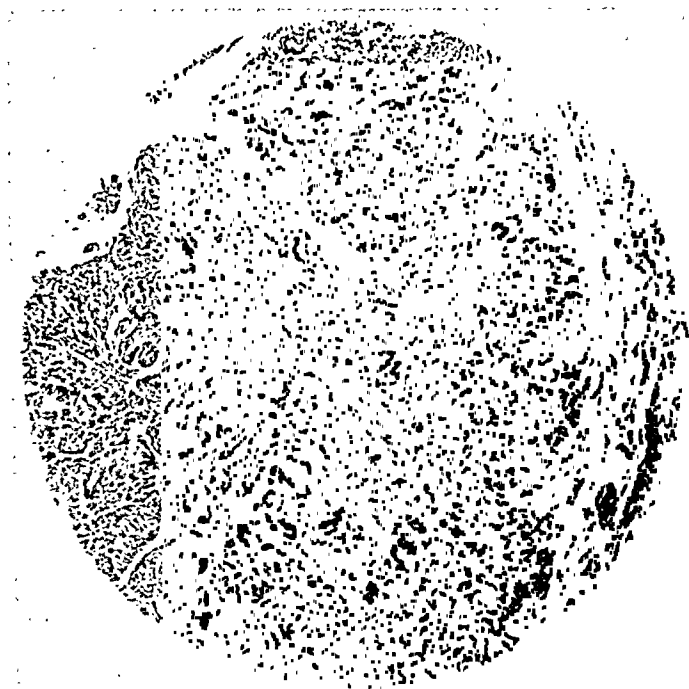


Fig. 3.—Left tube: The papillary form of carcinoma is largely effaced. Alveolar and adenocarcinoma are reproduced. Invasion into the tubal musculature is definitely shown. (x120.)

of the medium and small arterioles. The serosa is thickened, congested and has been largely replaced by implants of carcinoma. These reproduce long, slender folds with prominent secondary arborization. The histology of the cell is essentially as noted below in the description of the tubes. In other segments in the uterine wall invasion of the outer muscle fasciculi has occurred. Alveolar and glandular carcinoma is reproduced.

*Right Tube.*—Has been converted into a typical retort structure measuring 14 cm. long, 4 mm. transversely through the uterine junction and 50 mm. transversely through the dilated ampullar portion. The serous coat is smooth, though an occasional adhesion is encountered. Focally small irregular greyish nodules are encountered varying from 4 to 8 mm. in size. These are subserous in their location. On incision the lumen of the tube is dilated and in the outer portion filled with yellow inspissated material. After its removal the mucosa of the tube is well



shown. It is covered with numerous fine papillary processes which represent carcinoma. Where dilatation is less prominent the tube lumen is compactly filled with this tumor tissue occurring in broad tuberous masses or in fine papillary folds. The neoplastic process extends practically to the isthmic portion of the tube. Invasion into the muscle is focally noted and these areas correspond to the yellow plaques noted on the exterior of the organ. The parametrium is focally infiltrated. Microscopically: The lumen is filled with necrotic tumor debris. The mucosa has been converted into long, slender papillary masses with prominent branching. Centrally these contain a slender core of fibrous tissue and congested capillaries. The lining is comprised of 6 to 8 cell layers though many retain a solitary lining layer. The cell outline is poorly shown, the cytoplasm is scant; the nuclei oval and vesicular in type. Variation in size and stain are constantly noted. The muscle is edematous and atrophic; the serosa is similarly congested.

*Right Ovary.*—Is markedly atrophic, almond-shaped and measures 20 by 8 by 6 mm. The tunica is thickened and sclerotic; corrugation is marked. Surface implantation of the tumor tissue is lacking. On incision sclerosis is marked and diffuse. Small yellow granules studded through the organ suggest metastasis from the tube. Microscopically: The surface is clothed with adhesions. The cortex and medulla present diffuse sclerosis. Alveoli of necrotic metastatic tumor deposits are noted in the medulla. The pattern reproduced is that of adenocarcinoma.

*Left Tube.*—The organ has been traumatized on removal rendering its gross description somewhat difficult. It measures after reconstruction 80 mm. long, 4 mm. transversely at the uterine end and 5 mm. transversely in the ampullar zone. The uterine and isthmic portions are densely covered with surface papillary masses as noted over the uterus. The remainder is covered with adhesions. The abdominal ostium as such is not recognizable. On incision the lumen is found dilated but collapsed due to trauma thus distorting the size. The mucosa is largely replaced by fine papillary masses found in all segments. Extension into the muscle is frequently noted. In the isthmic portion the lumen is dilated and replaced by compact tumor tissue, which is sharply defined from the wall of the organ. Microscopically: The lumen is obliterated. This is the result of fusion of papillary excrescences on opposing walls. The general features are essentially as described in the right tube, but irregular alveoli of tumor cells infiltrate the muscle coat reaching the serosa.

The left ovary which was grossly recognizable is fused with the tube and broad ligament. It measures 20 by 18 by 8 mm. Surface is corrugated. On section it presents diffuse sclerosis. Microscopically it is free from metastases.

*Diagnosis.*—Senile involution of uterus; carcinomatous implants; bilateral papillary adenocarcinoma of the tubes; metastatic carcinoma of right ovary; secondary peritoneal carcinomatosis.

Thanks are hereby extended to Dr. Luther F. Warren for permission to report this case and to Mr. James V. Dunn for the excellent photographs.

#### REFERENCE

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1530 PRESIDENT STREET.

# THE TREATMENT OF ASPHYXIA NEONATORUM BY THE INJECTION OF ALPHA-LOBELINE INTO THE UMBILICAL VEIN\*

## A PRELIMINARY REPORT

BY ROBERT A. WILSON, M.D., BROOKLYN, N. Y.

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ALPHA-LOBELINE is more or less familiar and used in many of our large hospitals, although reports of its efficacy are conflicting. There are two principal reasons for this; one, a lack of proper indications, and the other, that it has often been used intramuscularly when only intravenous introduction could possibly have been of much use. A large number of cases, carefully controlled and scientifically observed, is necessary before the medical profession can know the status of this drug. This has not yet been done.

The principal alkaloid of the plant is lobeline, which, until recently, had only been isolated in the form of amorphous salts. These salts exhibited to a great degree the property of producing emesis, and this was considered their principal action. Because of the difficulty of obtaining them chemically pure and of regulating the dosage, they were seldom used for this purpose, however.

In 1916, Wieland, in Germany, succeeded in preparing a pure, crystalline, hydrochloric salt, and it is this preparation which was used in the cases herein reported. It differs markedly from the previous amorphous preparations, in that it does not cause vomiting.

I believe that the experimental pharmacologic evidence that alpha-lobeline is a respiratory stimulant is convincing and refer to the appended bibliography.

The action of alpha-lobeline on the blood pressure, heart muscle, and pulse is not marked, but it has been shown to have a favorable action on the circulation, even though it can hardly be considered a heart stimulant.

Opinions rarely agree on the treatment of asphyxia neonatorum. Broadly speaking, fetal asphyxia is due to two distinct causes:

a. Actual injury to the respiratory center during delivery, with encroaching intracranial hemorrhage.

b. Respiratory center depressants and poisons.

Under the latter heading come morphine and other drugs; prolonged

\*Read at a meeting of the Brooklyn Gynecological Society, February 3, 1928, and of the section on Obstetrics and Gynecology of the New York Academy of Medicine, February 28, 1928.

anesthesia, resulting in the presence in the baby's blood of large quantities of ether, chloroform, etc.; and, lastly,  $\text{CO}_2$ . When present in proper quantity,  $\text{CO}_2$  is a respiratory stimulant, but an excess quantity first depresses and finally paralyzes the respiratory center. If the asphyxia is due to  $\text{CO}_2$ , we may combat it by artificial respiration. If additional poisons such as ether, chloroform, and particularly morphine are present, there is then a double burden on the center. The need in such a case is for a direct respiratory stimulant in order to raise the threshold of response to a point where the center can again function itself. This we have in alpha-lobeline, providing that it can be quickly brought in sufficient concentration to the center. Because of the poor circulation usually present in asphyxiated babies, the drug must be exhibited intravenously. Slow, doubtful, or negative results from the use of this drug have principally been due to failure or to poor absorption from intramuscular or subcutaneous injections.

In those cases in which the respiratory center has been extensively damaged by trauma, little can be expected from alpha-lobeline or any other measure, although in several instances following its use, irregular, spasmodic respirations were obtained, but not long sustained. Autopsy in these cases always disclosed serious damage to the center.

The intravenous effect of the drug lasts from ten to twenty minutes, but this, as a rule, is amply sufficient. Subsequent intramuscular injections, in view of the improved circulation, will then suffice to carry on for a longer time the desired stimulation if it is still needed. Quick action on the center can be obtained only by intravenous injection.

It is convenient to divide the treatment of asphyxia neonatorum as follows:

a. Cases in which the center is severely traumatized and nothing is of any avail.

b. Cases of moderate asphyxia in which the center is not too severely depressed and which, after clearing the throat of mucus, respond to any or all of the simple methods, such as flagellation, the alternate application of heat and cold, etc. These cases respond because a stimulus is carried to a center still susceptible to stimulation. In the last analysis, however, these methods only hasten respiration, for it has been fairly conclusively shown that a child who responds in this way will breathe spontaneously if left alone, although considerable time may elapse before it does so.

c. Cases of grave asphyxia, with a center so markedly poisoned and depressed that the aforementioned methods are of no avail. If a response to these methods is not obtained in a reasonable length of time, they should certainly not be persisted in. Violent maneuvers, often frantically performed, have killed many babies and are never indicated.

For the past two years, alpha-lobeline has been employed in the Methodist Episcopal Hospital in the treatment of asphyxia neonatorum, but until recently only by the intramuscular route. Used only in severe cases and in conjunction with other methods, it was difficult to get a true idea of its value. In spite of this there was an impression among members of the staff that it was helpful. Following its injection, the babies appeared to respond more readily to the usual stimulative methods and particularly to artificial respiration. Because of this, it was always kept available for instant use.

After hearing of some excellent results in adults following the intravenous use of alpha-lobeline in the treatment of morphine poisoning, we felt strongly that if it was to be of real help in our birth asphyxias, it undoubtedly ought to be employed in the same manner to determine its clinical efficiency and usefulness. It was first necessary, therefore, to find a portal of entry into the blood stream which would be rapid, safe, and could be generally employed. After considering direct implantation into the heart chamber, also the use of the longitudinal sinus, and discarding them as too dangerous, except as a last resort, the umbilical vein evidently offered the best means of access to the blood stream for this or any other drug.

A careful search of the literature fails to reveal that alpha-lobeline has been employed in this manner before, and we believe this to be largely the reason for the uncertain results often obtained. Leibowitch, of Moscow, in 1925, discussed the resuscitation of the asphyxiated newborn by means of the intraumbilical injection of physiologic salt-adrenalin solution. He stated that he was unable to draw conclusions from the small number of cases observed, but recommended its trial in those cases in which there was no prospect of success with other methods. I realize that before definite conclusions can be drawn a large number of cases are necessary. At the present time we are keeping in the hospital a careful record of each case with the following data: (a) the type of labor and delivery, (b) period of gestation, (c) medication employed, (d) anesthetic used, (e) type and degree of asphyxia, (f) preliminary stimulation of child, if any, (g) heart rate when born, (h) time and dose of alpha-lobeline, (i) number of seconds elapsing following its injection to the first respiration, (j) the character of the succeeding respirations and the heart rate, (k) the later course of the child.

This preliminary report is presented in order to draw attention to the use of this drug in the manner to be described and to suggest its use in cases of grave asphyxia, especially if other methods have failed. Its employment requires little skill and it is hoped that the results which may be obtained will be reported as soon as possible.

## TECHNIC OF INJECTION

The infant dose of alpha-lobeline is  $1/20$  of a grain. In our maternity service, a sterile ampoule of the drug and a sterile syringe are kept on the delivery table and if it is feared that the baby is asphyxiated, the syringe is filled with the drug before the birth in order that valuable time may not be lost.

If injection is determined upon, an assistant holds the baby by the feet with the head down. The operator grasps the umbilical cord with one hand and, picking a favorable site, the needle, with its point directed toward the baby, is

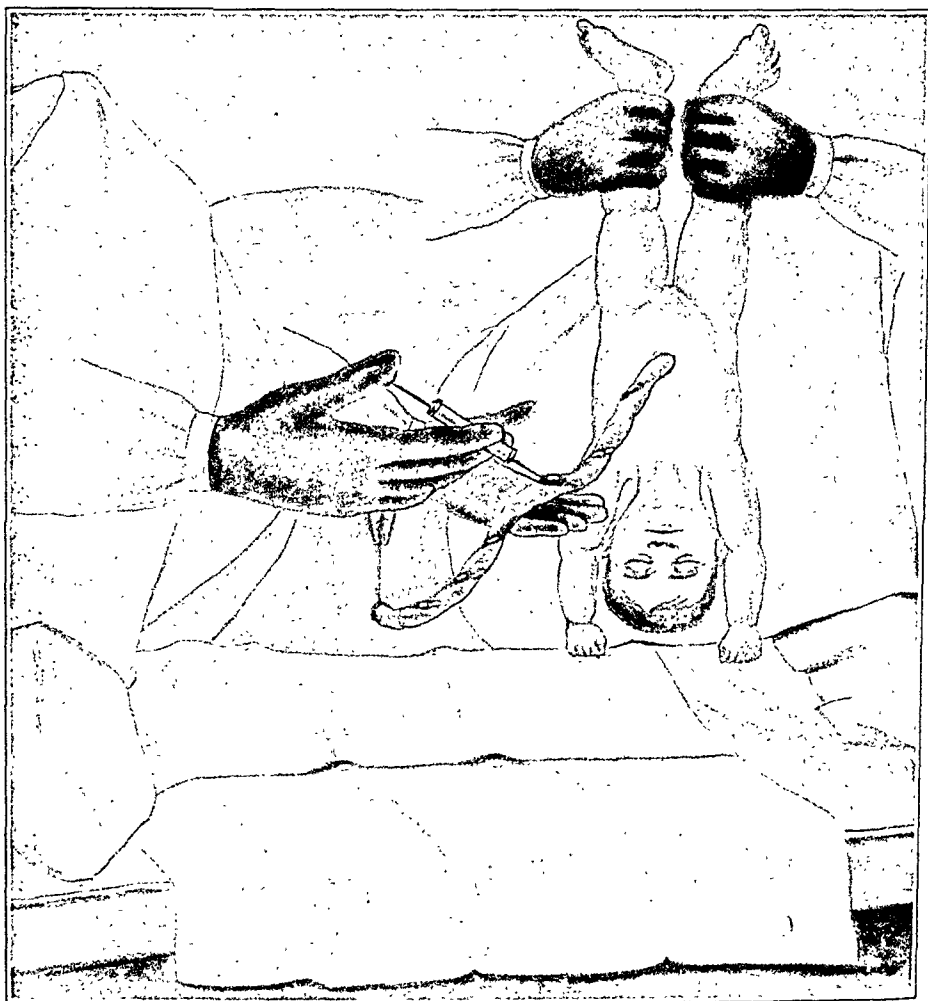


Fig. 1.—Showing injection of alpha-lobeline in the umbilical vein of an asphyxiated infant.

inserted at an angle of 45 degrees into the umbilical vein. When the needle is felt to be in the lumen, the piston of the syringe is slightly withdrawn in order to verify this. If blood appears in the syringe, the alpha-lobeline is injected, the needle withdrawn, and a finger placed for a short time over the wound.

If the following points are kept in mind the identification of the umbilical vein is easy:

1. The umbilical vein is larger than either individual artery.
2. Both arteries run a more or less spiral course around the cord while the umbilical vein takes a more direct one.

3. The umbilical vein usually discloses points of dilation and varicosity and this in conjunction with its greater size will identify it in most cases.

4. The most important point is the fact that the vein does not pulsate and the arteries do. This can be easily detected by placing the tip of one finger lightly against the vessel wall. The pulsations are distinct and easily palpable when the arteries are touched but are not felt when the vein is palpated. If this be borne in mind, there ought to be no difficulty in identifying the vessels. If such a difficulty should arise, it is best to inject all three, using  $1/3$  of the ampoule for each, as this quantity has been found sufficient to produce a reaction after the umbilical vein has been entered.

The point has been raised that the cord pulsations might have ceased. If this were so, the baby would be dead, for pulsations continue in the umbilical arteries, although often very faintly, until respirations commence or the heart stops. With the expansion of the lungs at the time of the first respiratory movements, definite changes occur in the

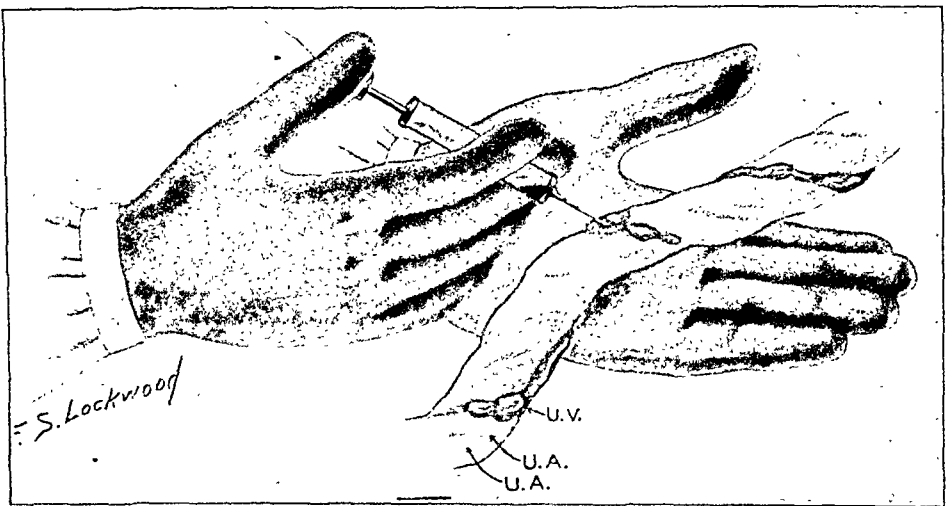


Fig. 2.—Showing a favorable site for injection. Note the blood in the syringe which proves the needle has entered the lumen. U.A., uterine artery; U.V., uterine veins.

fetal circulation and the cord pulsations actually do cease, but as the baby is now able to breathe spontaneously alpha-lobeline is no longer needed intravenously. We can sum up by saying that until the advent of respirations, the umbilical portal of entry is always open, after which, this portal is no longer needed. The vein should not be pierced too near the abdomen of the child, to avoid the presence of a puncture wound between the cord tie and the baby. Any point in the cord distal to where it will be tied may be used although we prefer one about six inches from its insertion, providing the umbilical vein is adaptable for puncture at this point. If the cord has been clamped and cut during or after delivery, the technic is the same, except that, following the withdrawal of the needle, the blood in the vein should be milked into the infant. This is done by compressing the cord near the clamp between two fingers and sliding these fingers along the cord, thus pushing

its contained blood into the baby. This gives results practically as good as if the cord had not been clamped.

#### CASE REPORTS

We have used alpha-lobeline in the manner described, thirty-five times in the maternity service of the Methodist Episcopal Hospital. As this is a preliminary report only, no attempt will be made to analyze these cases. Only a few can be cited.

CASE 1.—A. P., aged twenty-four, para i, was admitted March 25, 1927. She had a spontaneous delivery of a full-term, 7 pound 15 ounce child, following a seventeen and one-half hour labor. Morphine, gr.  $\frac{1}{4}$ , six hours previous to delivery and morphine, gr.  $\frac{1}{8}$ , with scopolamine, gr.  $\frac{1}{450}$ , four hours before delivery, had been given. The baby showed evidence of deep asphyxia and failed to respond to the usual methods of resuscitation. Seven minutes after delivery one ampoule of alpha-lobeline was injected into the umbilical vein; the baby commenced to breathe exactly fifteen seconds later, and its course from that time was uneventful. This was the first time that alpha-lobeline was used in the umbilical vein and the effect was striking.

CASE 2.—C. McC., aged twenty-seven, para i, was admitted August 23, 1927. She was one week past term and had had a negative pregnancy until one week before delivery, when a marked rise in blood pressure, and the appearance of albumin in the urine warned of trouble. Labor commenced spontaneously, but during its course a severe convulsion occurred which was followed in the next eight hours by two more. The patient was given morphine, gr.  $\frac{1}{8}$ , and chloral, gr. 10, and following a difficult forceps delivery under deep ether anesthesia, the baby was deeply asphyxiated (asphyxia pallida). During the next five minutes it failed to respond to all treatment, including mouth to mouth insufflation, and, as the heart had practically stopped, its condition appeared desperate. One ampoule of alpha-lobeline was injected into the umbilical vein and in twelve seconds an initial respiration occurred. This was at once followed by marked continuous respiratory movements, quickly reaching a maximum and then gradually subsiding, reaching normal about ten minutes later. The color quickly improved, no after-effects were noted, and baby and mother left the hospital on the thirteenth day, in good condition.

CASE 3.—M. C., aged twenty-four, para i, was admitted March 27, 1927, with negative history and physical findings, but with a threatening premature labor. In order to prevent, if possible, further labor, chloral, gr. 10, and sodium bromide, gr. 40, were given by mouth and morphine, gr.  $\frac{1}{4}$ , by hypodermic. Despite this medication the patient gave birth five hours later to a premature infant, weighing only 2 pounds 9 ounces. A faint cardiac impulse was discernible, but the condition of this baby appeared hopeless. It hung flaccid and was almost black in color. One ampoule of alpha-lobeline was injected into the vein without difficulty, although the cord was very small. Respirations commenced within a few seconds, the baby improved and remained in fair condition for a few hours, but became cyanotic and died five hours later, apparently of prematurity. No autopsy was obtained.

CASE 4.—J. S., aged twenty-five, para i, was admitted May 1, 1927, two weeks past term. This patient had a long, difficult, nineteen and one-half hour labor which had to be terminated by a difficult forceps operation under ether anesthesia; the baby weighed 10 pounds  $3\frac{1}{2}$  ounces. Morphine, gr.  $\frac{1}{4}$ , had been administered

seven hours before delivery and morphine, gr.  $\frac{1}{6}$ , two hours previous to delivery. The baby presented a typical picture of asphyxia pallida and would not respond to efforts of resuscitation including artificial respiration. The cardiac impulse was almost imperceptible, and as fourteen minutes had elapsed following delivery, without further delay one ampoule of alpha-lobeline was injected into the vein. Ten seconds later, respiratory movements similar to those described in Case 2 commenced. The baby's condition instantly improved and from that time onward it ran an uneventful course.

CASE 5.—E. B., aged twenty-two, para i, was admitted July 14, 1927, with a severe pyelitis. When three weeks from term she spontaneously went into labor and was delivered of a premature 4 pounds 14 ounce baby. Its condition was poor and despite our efforts it refused to breathe. One ampoule of alpha-lobeline was injected into the vein ten minutes after delivery, and the baby responded in seven seconds. It did well from that time onward.

CASE 6.—I. C., aged twenty-nine, para ii, entered November 4, 1927. After nine and one-quarter hours' labor she was delivered by forceps, under ether anesthesia, of an eight pound baby which was moderately asphyxiated. For five minutes it refused to breathe and although the heart action and general condition were good, one ampoule of alpha-lobeline was injected. In exactly seven seconds the baby commenced to breathe vigorously in the manner characteristic of alpha-lobeline stimulation.

CASE 7.—A. P., aged thirty-eight, para i, entered November 17, 1927. Her blood pressure was 200/120, she was very toxic and completely blind. There was also marked tenderness over the liver and a jaundiced skin. Although only seven months pregnant, she was delivered under ether anesthesia a few hours later by a classic cesarean section because of the urgency of her symptoms. Morphine sulphate, gr.  $\frac{1}{4}$ , had been given four hours before operation. The baby weighed 3 pounds, was pallid and refused to breathe, although every effort was used to make it do so. After five minutes had elapsed, and the cardiac impulse being then almost imperceptible, one ampoule of alpha-lobeline was injected. In seven seconds an initial respiration occurred which was quickly followed by others. The heartbeat returned, the color improved and the child was soon out of immediate danger. The result in this case was dramatic, it being the feeling of all present that the infant was undoubtedly saved by the alpha-lobeline. At this date, January 10, mother and child are doing well.

CASE 8.—M. S., aged twenty-eight, para iii, entered February 9, 1928. She had a history of two instrumental stillbirths, and expressed a keen desire for a living child. The history was otherwise negative. Pelvic measurements indicated a generally contracted, flat pelvis. A classic cesarean section, under local anesthesia, was done because of the large size of the baby (8 pounds 4 ounces), the contracted pelvis, and failure to progress after seventeen hours of labor. One hour before operation scopolamine, gr.  $\frac{1}{450}$ , and morphine sulphate, gr.  $\frac{1}{6}$ , were given. Thirty minutes later this medication was repeated.

Upon opening the uterus, the cavity was found to be filled with meconium-stained fluid, and the baby, when extracted, was limp and very white. It was first treated conservatively by aspiration of mucus and flagellation, but as the heartbeat was slow and faint, artificial respiration was resorted to. Despite these measures the child became worse, and although every effort had been made to resuscitate it without the use of alpha-lobeline, the condition was now so bad, the cardiac impulse so slow and faint, and the child so near death that alpha-



lobeline was used as a last resort. Sixteen minutes following delivery, one ampoule of alpha-lobeline was injected. Twelve seconds later, although only seven seconds after the milking of the blood from the cord, which had been previously clamped, an initial respiration occurred. Others quickly followed, and in a few minutes the baby was in excellent condition and has done well since.

#### DISCUSSION

The outstanding feature, when alpha-lobeline is used in the manner described, is the rapidity of its action. The primary respiration occurs from seven to fifteen seconds following injection, undoubtedly depending to some extent upon the efficiency of the circulation. In cases in which the cord is clamped and it is necessary to milk the blood into the baby, the reaction is slower but does not take more than twenty seconds. Little difference has been noted with smaller doses of alpha-lobeline or when the degree of asphyxia varies widely. The early respiratory movements are different from those usually seen in an asphyxiated child. They are full and rapid from the beginning and cause an almost instantaneous disappearance of cyanosis. The babies rarely cry for some little time, apparently because of the rapidity of the respirations. These respiratory movements gradually subside, however, and in fifteen minutes or less the breathing appears normal.

It would be well to now consider the safety of alpha-lobeline. Mennet, in 1925, reported marked reactions following its use in asphyxia neonatorum, thus confirming reports of spasms and tetany made by other authors. Lang, in 1926, and Pfeilsticker in 1927, also spoke of these reactions. Both these authors, however, felt that the untoward effects were due to impurities or faulty manufacture rather than to the drug itself. Mennet, writing again in 1926, stated that he believed complications were due to an impure product and that, if the purity of the drug were guaranteed, there would be no danger in its use and that, in combating asphyxia, excellent results could be expected.

Whatever the cause of the reactions reported, in our own work with the drug no after effects have yet been observed. The babies are not spastic, do not vomit, and appear the same as babies which have not been subjected to this treatment. We have not had a sufficient number of cases to give a final answer to this question, but feel so far that no harm will follow its use providing that due regard to asepsis be given at the time of injection.

Some writers claim that an early complete expansion of the lungs is desirable to prevent certain types of atelectasis. Because of this I feel that alpha-lobeline can be used to advantage even in those babies which would eventually breathe spontaneously, but are slow to do so because of the presence of morphine, excess  $\text{CO}_2$ , etc.

The injection of alpha-lobeline directly into the heart has been recommended, but this is dangerous and never indicated unless the umbilical

method has failed, and the baby is apparently dead. If so used, it should be preceded by an injection of adrenalin.

### CONCLUSIONS

1. It is recommended that alpha-lobeline be injected into the umbilical vein for the treatment of asphyxia neonatorum, the dose being from 1/40 to 1/20 of a grain.

2. The umbilical vein is easy to identify and enter, but in case of doubt all three vessels may be injected to insure the presence of the drug in the vein. The vein is always available for injection until respirations commence.

3. The clinical results have so far been encouraging; the initial respiration occurring from seven to twenty seconds after injection, and the action of the drug lasting from ten to twenty minutes.

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## THE FEMALE SEX HORMONE. IX. POSSIBLE SIGNIFICANCE OF THE RODENT VAGINAL SPREAD REACTION IN THE MALE BLOOD

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IN NUMEROUS previous publications we have demonstrated the presence and distribution of the female sex hormone in the circulating blood.<sup>1, 2, 3, 4</sup> This method has proved of use in clinical diagnosis and in the purposeful planning of therapy.<sup>5, 6</sup> The presence of the active substance has been demonstrated by means of the mouse

vaginal spread as introduced by Stockard and Papanicalou,<sup>7</sup> Long and Evans,<sup>8</sup> and Allen and Doisy.<sup>9</sup>

Recently investigators have shown a positive reaction to the rodent vaginal smear in the urine and even in the blood of males.<sup>10, 11, 12</sup> In a preliminary paper on the significance of the female sex hormone reaction in the male blood<sup>13</sup> we have published the results obtained on 60 bloods from 47 male patients in which 40 showed a negative reaction, 3 showed a threshold reaction, and 4 showed doubtful, weak reaction. These males were of all ages, extending from nineteen to fifty-five years, and of the married ones, 3 had had several children. Our results obtained on the urines of twelve men were uniformly negative, although huge quantities were used for extraction and injected into the test mice.

These results do not in any way modify or impair the results obtained on females, including even the attempts at determining sex,<sup>14</sup> because in the female a cyclical reaction, that is the regular reappearance of a positive test at a comparatively fixed interval (say twenty-one to twenty-eight days), can only be explained by ovarian action. The interpretation of a positive finding in the male is of the greatest theoretic as well as practical interest.

In our preliminary paper<sup>13</sup> we said that these findings may be variously interpreted. (1) The vaginal spread reaction may not be specific. (2) The male and female sex hormone may produce the same reaction on the castrate rodent employed for the test. (3) Certain males, though apparently normal, may be latent hermaphrodites, possessing an ovotestis and, therefore, able to produce sufficient female sex hormone to appear in the blood. Anatomically such individuals have actually been described, the findings being either confirmed at operation or at postmortem.<sup>15</sup> An attempt has been made further to elucidate this question by means of experiments. These experiments may be divided into three groups.

The first group consisted of the injection of huge amounts of testicular extracts into castrated rats and mice. These experiments extended over the last five years.<sup>16</sup> Fresh bull testicles were finely minced, sometimes also rubbed up with sand, and subjected to extraction with saline solution, decinormal hydrochloric acid, decinormal sodium hydrate, plain water, alcoholic extractions, ethereal extractions, and the resultant extracts injected over longer or shorter periods. In no case was the slightest indication of a positive result obtained by the vaginal spread reaction.

A second set of experiments was based upon work published by Carminati<sup>17</sup> in which this author claimed to have obtained positive results by taking fresh rat testicles and injecting a 1 to 5 saline suspension into castrated female rats. We repeated this work exactly according to the directions of the author with negative results, and

thereafter ran several other sets of experiments in which we used much larger dosage, a daily freshly made extract, and continued the injections over double the period mentioned by this investigator, with negative results throughout.

Finally, we injected rats with a lipid extract prepared by one of us (McGee), according to a method similar to that published by Frank and Gustavson<sup>18</sup> for their extraction of ovary and placenta; these extracts having been tested out on capons, according to the method previously published<sup>19, 20</sup> in which animals they had produced well marked increase of combs, wattles and ear lobes. Large quantities of these extracts injected into female castrate rats over a considerable period of time, with variations of quantity and time, so as to produce the optimum results, were likewise negative.

From these negative results obtained from all testicular extracts thus far tried by us, we feel justified in believing (1) that the rodent vaginal spread test appears specific for the female sex hormone; (2) that testicular extracts do not give a positive rodent vaginal smear reaction; (3) that a positive reaction obtained occasionally in a male is as yet unexplained. We are at present attempting to investigate whether this occasional find might offer a physical basis for homosexuality.

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# THE RIGID AND STENOSED CERVIX IN THE FIRST STAGE OF LABOR\*

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IN A PREVIOUS paper,<sup>†</sup> we have discussed the rôle of the various factors causing scarring with resultant cervical rigidity. In the following paper we will give reasons for our belief that true primary cervical dystocia is practically always due to fibrosis, in spite of appearances and opinions to the contrary. We will consider the diagnosis and treatment of this and allied conditions complicating the first stage of labor.

## ETIOLOGY AND PATHOLOGY

The normal cervix contains proportionately more connective tissue intermixed with its smooth muscle and elastic fiber than does the body of the uterus. The racimose nature of the glands of the cervix, its exposed situation, and its frequent subjection to trauma and bacterial invasion make it the common seat of chronic infection. Physical, chemic, and bacterial irritation keep up a slow smouldering destruction of the specialized muscle and elastic fibers, which are replaced by the faster growing, hardier, but nonexpansile scar tissue cells. All other things being equal, the ability of the cervix to dilate is directly proportionate to the amount of muscle and elastic tissue elements as compared to the fibrous tissue content. The arrangement of the scar fibers, however, is important. They contract or shrink with time, and do not again relax. If their arrangement is circular, their action simulates sphincteric closure. If they are irregularly disposed, they may cause distortions, knobs or bands, interfering with the orderly dilatation of the parturient canal. We believe that this substitution process, due to whatsoever cause, is present in practically every true rigidity or stenosis of the cervix.

Following the literature back to the middle of the 19th century, we find that the classifications of dystocia include a "spasmodic or functional" type of rigidity of the cervix (Taurin, Viguier, and others).

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†*Am. Jour. Obst. and Gynec.*, August, 1928, xvi, 258.

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The use of the word functional in this regard seems to us a paradox, for the physiologic "function" of the cervical musculature in labor (i.e., its normal action) is to *dilate* the cervical canal. As Sturmdorf says, "*Cervical dilatation* becomes an integral part of uterine *contractions*."

The presence of a muscular mechanism to accomplish dilatation (longitudinal and oblique layers) has been quite well established; but there is considerable controversy in regard to the existence of a definite circular layer which might accomplish active closure. It is thought by many that tonus during pregnancy is maintained by such a circular layer, and that the loss of its integrity, as in deep lateral tears, facilitates abortion or miscarriage by permitting gaping. During labor, according to this theory, the dilating mechanism dominates, the circular fibers being reflexly inhibited. This conception seems to have its origin in an hypothetic similarity between the physiology of the cervix and that of various sphincters rather than on clearly established anatomic and physiologic grounds. Rational as it may seem, it does not account for the countless full-term pregnancies and normal labors which occur in the presence of vicious cervical distortions, or following radical amputation of the cervix. Sturmdorf and others flatly deny the existence of any continuous circular layer of cervical musculature, and maintain that the fibers are "disposed in a serried succession of oblique circle segments \* \* \* which widen the os like an iris diaphragm of a microscope." We must admit that in general, results of studies of the cervical musculature do not leave a clear cut impression of finality. However, it is our interpretation that the normal caliber at all times is maintained by the anatomic conformation of the part, as in other nonsphincteric orifices, rather than by a mechanism of specialized continuous circular fibers.

In view of the mass of conflicting opinion we submit: (1) that the actual existence of an active contractile mechanism is not established; (2) that even those who claim the existence of such a mechanism assign to it a negative function during labor; and (3) that the element of scar or diffuse fibrosis is present with an uniformity which explains the majority of the so-called anatomically or spasmodically rigid cervixes. We must admit with Ehrenfest, that occasionally, clinically, we are confronted with a case of apparent primary cervical dystocia which seems to present a problem of abnormal cervical innervation, but in a careful study of this type of case as reported in the complete literature the lack of conclusive anatomic and pathologic background for such an hypothesis is striking.

The etiology of the so-called functional or spasmodic nondilatability is most often ascribed to fault in either the nervous or neuromuscular mechanism of coordination. The concensus of opinion in regard to the anatomic relation of the cervical muscle to that of the corpus

is that the important connection is through the middle layer, which is more in continuity with the muscle of the corpus than any other layer and would logically fulfill the function of a coordinating conduction system similar to that of the Purkinje fibers of the heart. It seems reasonable to suppose that this continuity might be important in the control of rhythmic contractions of the uterus in labor, and that its disruption might cause a cervical dystocia due to incoordination, a sort of uterine "bundle block." There is evidence for such a theory, yet we have seen a sufficient number of normal labors following distortions or radical amputation of the cervix (see also Rawls, Audebert, Pozzi, etc.) to convince us that the integrity of such a mechanism is not an absolute essential to the normal sequence of labor. We think it more likely that the fibers which dilate and "take up" the cervix during labor are hampered by the presence of inert connective tissue cells, and must act at unusual and disadvantageous angles; in other words, that the interference is with the mechanical efficiency of the muscle rather than with an hypothetic conduction system.

The following case seen in consultation by one of us is illustrative:

Case Report (Dr. Albert Holman).—Mrs. S., St. Vincent's Hospital. The patient was a primipara, forty-three years old, at term. Induction was attempted and the patient had indefinite and irregular pains, described as pseudolabor, for seventy-two hours, following which she had fourteen hours of severe but more or less irregular labor pains, increasing in severity but without notable effect either in descent of the presenting part or in thinning or dilatation of the cervix. There was breech presentation and numerous small fibroids were notable on the fundus, prior to delivery. Morphine-scopolamine was used liberally throughout the four days. After consultation, cesarean section was determined upon because of (1) prolonged ineffectual contractions, (2) advanced age, (3) primiparity, (4) fibroids, and (5) breech presentation.

Cesarean section was performed and was uneventful. The baby survived and convalescence was without serious event. The operative report states that the uterus contained approximately 15 small fibroids varying in size from an almond to a walnut.

In this case we feel that the replacement of smooth muscle and elastic fiber by nonexpansile fibrous tissue, hampered the normal action of the remaining muscle of both cervix and corpus and that the distortion caused the fibers to act from unfavorable angles and ineffectually.

We do not believe that there is a nervous or neuromuscular mechanism of coordination between cervix and fundus, indispensable to the successful dilatation of the cervix in labor. If there is such a mechanism, it is not of a sort to be incapacitated by gross anatomic alteration of the tissues involved (amputation of the cervix, trachelorrhaphy), or by paralysis of the local innervation (spinal block) or injury to the great cervical ganglia lying lateral to the cervix.\* The insidious

\*These ganglia are normally about one-half inch in diameter, but during pregnancy increase to as much as two inches. They extend very low and are involved in all extensive lateral tears.

invasion by fibrosis together with the extreme frequency with which it is encountered leads us to believe in the great likelihood of the fibrosis as the cause of such cervical dystocia, rather than in a delicate and poorly defined mechanical balance between corpus and cervix.

There is a definite parallel between the occurrence of fibrosis and cervical dystocia with uterine inertia in the case of elderly primiparae. The relation is one of cause and effect. Nor are the congenital cases exempt from this category for even where there seems never to have been a cervical canal, there is found an increase of fibrous tissue. Nagel conducted studies from which he deduced that in the embryo there might be friction between the lower ends of the Mullerian tubes, with resultant irritation and scar tissue formation, obstructing a part of the opening formed by the later fusion of these two conduits. Such an abnormality would be present at birth and followed in some cases by an ulceration due to the contact of the two lips, with scarring and resultant stenosis or atresia.

Baudeloque and his school (Wallich, Bouffe de St. Blaise, Doleris, Barnes, etc.) denied the existence of complete atresias of the cervix, and believed that the majority of cervical dystocias were functional, and not due to tissue change. Only a part of the material on which their conclusions are based is available, but the cases of Wallich and Bouffe de St. Blaise are indicative. They examined microscopic sections of pieces of tissue in such cases, which had been brought away by the head, or occasionally by the forceps. They found no gross tissue change, except a marked edema. They deduce from this that there was no original pathology in the cervix. In the first place, there might have been sclerosis elsewhere in the cervix. In the second place, we submit that this finding together with the clinical picture suggests definitely the type of case in which a prolapsed cervical lip (usually anterior becomes pinched and enormously edematous, and may retard labor indefinitely until it is slipped back, or incised, or, as seems to have been the case here, carried away by the presenting part. We have analyzed the observations of this group (Wallich, Bouffe de St. Blaise) because they constitute the best organized attempt to establish as a clinical entity a true spasmodic or functional rigidity of the cervix. Their presentation is not convincing.\*

The above group of cases shows a suggestive similarity to a type of dystocia which we have encountered clinically *and have not as yet found clearly described*. We refer to cases in which the head fits into the inlet, often quite deeply, but always very tightly, so that it is difficult to move it digitally, either from below or above. Passage of the

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\*Quite recently our attention has been called to a case reported by Greenhill (Jour. Am. Med. Assn., 1922, lxxviii, 98) in which there appeared to be an active contraction of the cervix about one thigh of the child during a cephalic delivery. There was an enormous edema of the part thought due to pressure by the cervix. If such was the case, we must accept it as very difficult to explain. The case is unique.



head through the inlet is very slow and the cervix remains thick, dilatation not progressing, though the contractions may become very forceful indeed. There is a tendency to feel that the bony disproportion is not responsible for the failure of the cervix to take up and dilate in these cases, since often, after a long hard labor, the head is found to pass successfully. The relative bony disproportion is, of course, important, and we believe that the circumferential pressure of the tight head against the pelvic brim and walls mechanically compresses the tissue of the lower uterine segment and inhibits the upward migration of the muscle fibers of the cervical walls. The taking up of the cervix is effectually checked; edema is induced by pressure on the vessels and the result is a thick undilated cervix in an otherwise well advanced labor. It would be easy to ascribe this failure to dilate primarily to the cervix, especially if the head is later delivered without serious mishap. If portions of the cervix were carried away in such cases, pathologic examination of the tissue, as in the cases of Wallich (etc.) would not reveal fibrotic changes, yet the cervix might seem the apparent cause of the dystocia. In a case recently published by Lee Dorset, the fetus was stillborn following the sloughing of a complete collar of cervix. The fact that there was a generally contracted pelvis indicates that the accident was unavoidable and that the cervix was not a primary factor in the dystocia. It illustrates, however, an extreme degree of the mechanism to which we refer. Confusion in regard to the rôle of the cervix in this type of dystocia is more apt to occur where the pelvic measurements are normal, but the head large and highly calcified.

An active functional contraction of the cervix late in the second stage is mentioned by several authors (DeLee, Viguiet, and others). This is said to occur especially in breech extractions, and is described as a tightening of the cervix about the neck of the child. We have seen conditions suggestive of such an occurrence but feel that the mechanism is of apparent rather than actual contraction. The fact that it is reported during breech extraction in every case is significant. The diameters of the breech and trunk being less than those of the head, there is a natural tendency for arrest of the head at the cervix. Moreover, with insufficient dilatation, extension of the head is apt to occur. The arrest will naturally occur with the cervix about the neck, and if the cervix has been stretched by traction from below or pressure from above (pituirine) to allow the passage of the trunk, it will tend to resume its actual circumference about the neck exactly as it does between pains over an advancing vertex. Thus, the apparent active contraction is seen to be rather a function of the normal elasticity of the cervix plus the obvious disproportion between the diameters of the canal and those of the more or less extended head. During two deliveries, one of a microcephalic, and the other of an anencephalic

alic, one of the authors noted the cervix apparently contracted about the neck of the fetus. The contraction was, of course, apparent rather than real, and due to the reversed disproportion between the sizes of the head and shoulders. We have not found reported a case in which such an apparent contraction occurred in the course of a vertex delivery of a normal infant.

A few authors (Tonef and others) feel that they are not infrequently able to distinguish the presence of a true spasmodic rigidity of the cervix early in labor. The theoretic and clinical background for such a diagnosis is, to say the least, obscure, and the diagnosis seems to have been made rather by inference and in view of preconceived ideas than upon tangible clinical data. In practice, the effort should be made to determine a sounder basis. Even if the dystocia can be shown clearly to be primarily in the cervix, and if both history and examination reveal the absence of data pointing to fibrosis, it is still not necessary to fall back upon an hypothetic "spasmodic cervical contraction" as the dystocic factor.

Ehrenfest has wisely called our attention to the apparent constitutional and psychic similarity between women who present most often this unexplained delayed cervical dilatation, and those who suffer severely from true dysmenorrhic pain: "in girls exhibiting the stigmas of underdevelopment—which so often is found associated with genital hypoplasia—in women with noticeable impairment of mental nervous balance, or again in those in whom a disturbed endocrine harmony is evidenced by somatic features often approaching male characteristics" (etc.). We are at present engaged in a detailed study of this relationship, the results of which we will report later. At present, we feel that such a concept should be carried clearly in mind in attempting to judge the actual stage of the labor by the apparent severity of the patient's suffering or by the relative mental and physical fatigue. We can expect a subconscious exaggeration of the early pain of onsetting labor from the type of woman who translates in consciousness the ordinary menstrual uterine contraction as exquisite pain.

First, we must realize that the major criterion of the period of labor (the cervix not progressing) is the patient's subjective report and our observation of the apparent severity of the pains. The degree of the uterine contraction as noted bimanually may be of value, but we have often felt prolonged firm contractions long before the onset of actual labor, and poor transient contractions with complete dilatation. We do not agree with Tonef that it is a simple matter for the trained observer to palpate an obstinate cervix and determine with ease the presence of "spasmodic rigidity." After all, the appearance and outcry of the patient are our chief index where the cervix does not progress normally. An exaggerated susceptibility to pain is too often

misconstrued and we find reported two- or three-day labors without progress, which, if carefully analyzed and treated with the exercise of the proper psychology, would prove to be merely the preparatory stage which is often calmly described to us by women of less suggestible mental habitus.

We have in mind a timid, youthful patient, very much frightened by the terrible prospect of her first childbirth, who, without our knowledge, was placed in the labor room with a multipara well advanced in labor. To our surprise we were called by the nurse to deliver this patient after a very few hours in the hospital. We found the patient in a delivery room adjoining that occupied by her former roommate with doors open between, and both women apparently in the agonies of the final pains of expulsion. Examination revealed that our patient had apparently not even begun labor as far as actual progress was concerned. She was taken to a quiet room, given a sedative and reassured as to her condition. She very soon fell asleep, and the following day went through a complete and perfectly uneventful labor.

It is this course of events which we believe is most frequently mistaken for a spasmodic nondilatability of the cervix. There are two factors contributing to confuse us: first, our inability to judge accurately, in the absence of normal cervical changes, the advance of other phases of the labor; and second, the degree of voluntary muscular resistance to descent which may be exerted by patients who fear acutely the pains incident to active cervical dilatation. This second factor is important also, and we believe that descent and dilatation can be effectively retarded by such a mechanism. We wish, however, to distinguish clearly between this general voluntary resistance and an hypothetic spasm of the cervical musculature which is innervated through the vegetative nervous system, and not under conscious control.

A word in regard to the extreme value of morphine and other worth while sedatives should perhaps be said here. The efficiency of such treatment in this type of case seems to us proof of the general as opposed to the local nature of the underlying cause, for such sedation has no specific local effect whatsoever. In contrast, we find little to support the specificity of belladonna or its derivatives in such cases. Theoretically, there should follow a relaxation similar to that seen in the iris or the gastrointestinal tract, were there an actual anatomic similarity. It is impossible, then, to absolutely deny the existence of a "spasmodic nondilatability" of the cervix in labor, but it seems that such cases of cervical dystocia as cannot be clearly shown due to fibrosis or scarring are best explained as due to other factors than "spasm."

Where there is no disproportion and no demonstrable cervical fibrosis, failure of the cervix to dilate may be due to displacement of the os. Frequently, this condition is also due to distortion from fibrosis tissue contraction. Occasionally, however, there seems to be a marked posterior displacement of the cervical canal which cannot thus be ac-

counted for. The cervical lips may lap one over the other, thus effacing the canal. More often the posterior overlies the anterior (T. C. Smith). The failure to dilate in such cases is due to the disadvantage at which the contents of the lower uterine segment must work as a dilator. A similar ineffective dilating mechanism is seen in cases of faulty presentation, where, because of its shape, the presenting part is ill adapted as a dilator. DeLee, Henderson, and others, believe that adhesions between unruptured membranes and the cervical walls, caused by endocervical inflammation, are not infrequent impediments to labor. Pressure by cervical tumors such as fibroids or polyps may determine a dystocia not primarily fibrous in nature, and, of course, in cancer, the rigidity due to the epithelial proliferation will interfere with dilatation. The rôle of caustics, cautery, and operation has been discussed in a previous paper.

Authors differ widely in regard to the frequency of the occurrence of syphilis of the cervix. The important injury is by the third stage lesion (Taurin) which causes a notable induration, or granulomatous overgrowth, and leaves an extensive scar. Doleris from an analysis of 15 cases believes the chancre to be the important lesion. Gellhorn points out that the induration in both chancre and gumma is greatly increased during pregnancy and may be the cause of marked cervical dystocia. Tuberculous ulcers, actinomycosis, or other special diseases of the cervix destroy specialized tissue and leave scars. The pin-point os or the occlusion of the senile cervix is only a function of the fibrotic tendency, plus the prolonged effect of imperfect drainage and the inroads of ever present infection in the cervical glands. A consideration of the mechanism by which these various conditions exert their action on the cervix serves to fix more strongly in our minds the uniformity with which fibrosis occurs as the basic pathology.

Practically all authorities (with the exception of Klob) agree that stricture or occlusion at the internal os is not as frequent as in the outer half of the canal. The most frequent site is the external os, as most of the injurious processes do not extend deeply along the canal. The tissue of the region of the internal os is retracted into the lower uterine segment during labor, and for this reason is seldom involved in the ordinary obstetric tear. The majority of cervical operations affect only the lower portion of the canal, and even caustic applications and cautery are not often carried to the internal os. Contracture of the internal os has been seen following curettement, and was a frequent sequel to the endometrial application of caustics such as zinc chloride. We believe that a not uncommon cause of scarring high in the cervical canal is the unskillful use of mechanical dilators. In untrained hands, these instruments may be not completely inserted, and the blades separated short of the internal os, with consequent tearing of the tissue in the upper half of the canal.

Where there is an actual fibrous obliteration of the entire canal or of any considerable part of it, the condition is invariably the result of rather complete denudation of the epithelium, whether due to disease or to trauma or to necrosis consequent on a circular scar which, in healing, exerts a slow sphincteric action of closure. In such a case, pregnancy is not apt to occur and the cervix will be of a fibrous consistency, often nodular and irregular, and frequently almost the consistency of cartilage. It is notable, however, that pregnancy may occur through the most viciously deformed cervixes. This type of sclerosis has been seen in collar-like rings of cervix carried away during labor (Tyler Smith). Cazeau described an occlusive cervical membrane as being "aponeurotic in nature" and so resistant that no moderate force could lacerate or break it. Mesnard speaks of a cervix so tough that it actually could not be cut with scissors and Coutade described the consistence of a cervix as "sclerotic, dry and woody." We would refer also to reports of cervixes so rigid as to cause a deep pressure groove, or actual necrotic ring on the scalp of the fetus.

We are interested in the condition early noted and first elucidated by Mattei in 1862, called "*conglutinatio orificii externi*," in which there could be ascribed no definite cause for the localized occlusion. He cites 19 such cases, and attempts to explain them on the basis of a fibrous organization of the static mucous plug in the cervix of pregnancy. Various modified conceptions of the theory have been held, but more recently, the condition is less often described, and the tendency is toward the idea that the basic factor is either disease or trauma, however mild. Kiwisch and others thought that the occlusion might be the function of a sort of cervical decidual reaction "representing an agglutinating layer, which afterward, when the canal is distended, is increased into a membrane of varying density." Lusk, Mme. de la Chappelle, J. Schmitt, and others believe that the cervical stasis associated with pregnancy is an important factor, and Virchow points to an allied condition of occlusion due to senile atrophy following cessation of the menses. The friable nature of this membrane, and its almost gummy consistency in some instances, are the reasons advanced by the older writers for believing that they were dealing simply with a toughened and tenacious plug of cervical mucus.

We have noted in several cases of our own, where there was failure to dilate, that the external os remained undilated due to a thin wiry ring of indistensible tissue at the precise region of the external os. Pressure by the finger or the tiniest of incisions serves to free such an obstruction. No doubt, there is a similarity between this condition and that described above, the difference being that in the latter case the external os is more widely open, and agglutination of the devitalized lips cannot take place. Schroeder believed that most of the cases thought to be completely occluded were of this type, with an external opening so fine as not to be discernable. Williams is inclined to agree with Schroeder in regard to the so-called "*conglutination*," yet mentions two cases of his own in which there was a "*complete atresia*" at the external os, and in which the histories presented no evidence of previous injury or disease.

#### DIAGNOSIS

*Diagnosis of Complete Occlusion.*—In the majority of cases of stenosis or occlusion occurring in the course of pregnancy, there will be no

variation in the normal course of events. The existence of the pregnancy establishes the fact that there must have been a patent canal through which the sperm might pass, but impregnation has been reported where there was sufficient occlusion to cause suppression of menses. Frequently, the history is not suggestive and even a careful digital examination may fail to establish the diagnosis of pathology which is not at the external os. In cases in which the history is at all suggestive, digital and specular examination should be made. The semi-prone or knee-chest position may be helpful to differentiate deviations or simply distortions of the canal. In complete occlusions, the absence of cervical mucus (dryness of vagina) is an important, though not constant sign. The presence of irregularities, distortions, and scarring will be suggestive. The diagnosis is less easy before the onset of labor. When labor has commenced, if the contraction is at the external os, as it is in most cases, the cervix will thin out and be more or less normally effaced, but dilatation will not occur. As a rule the presenting part will bulge into the thinned cervix and the region of the stenosed occluded cervical canal will be rather easily found due to the presence of localized thickening or irregularity often with a crater-like dimple. The cervix may become so thin as to be mistaken for the membranes of the fetal scalp. In some cases there may be absolutely no indication of the presence of a cervical canal. In such a case, a misplacement or deviation of the canal should always be considered and the greatest care used to exclude such a possibility. If the constriction is in the upper half of the canal, effacement will not occur even with the labor otherwise well advanced. The relaxed lower portion of the canal, however, will invariably permit the passage of a finger to the region of the occlusion and the diagnosis is seldom difficult. This type of occlusion, moreover, is as a rule, due to pathology which may be suspected from the history.

*Diagnosis of Stricture or Partial Occlusion.*—It may be difficult to distinguish between a complete occlusion of the cervix and a stenosis with only a minute opening or very small distorted canal; but it will be less difficult to determine the presence of stenosis in cases where a certain amount of dilatation has occurred. The history together with the traces of subsequent injury and disease should elucidate the presence of a causative fibrotic process. It must be remembered, however, that the absence of distortion or marked induration cannot be taken to exclude a diffuse fibrosis. As a matter of fact, the fibrosis dependent upon chronic endocervical infection, and that due to the insidious invasion by connective tissue (as in elderly primiparae) may deviate from the normal only in the exhibition of a moderate increase in density on palpation. Confusion may arise through the presence of conditions allied to the so-called "conglutination" of the lips (see page 398) or in the presence of a fine circumferential fibrous ring (see

page 398). It is not always easy to determine clearly the unique cervical origin of the dystocia. Beside clearly defined cervical dystocia, we have considered here only those conditions which simulated more or less closely such a condition. It is necessary of course to have at command a thorough knowledge of *all* types of dystocia, and to leave no stone unturned in the effort to eliminate all possible extra cervical contributory factors.

Again the history is important. Possible trauma (childbirth, operation, caustics, cautery, etc.) or disease (neisserian infection, persistent leucorrhea) or a history suggestive of indurative changes (premature or actual senile changes) of the sort seen in elderly primiparae, must be considered. Examination should be both visual and tactile and under aseptic precautions. It is unnecessary to describe again in detail the findings indicative of fibrosis, varying from gross distortion of the lips with extreme rigidity through lesser degrees of scarring and induration. Edema may be present to mask an underlying induration, but often is an indication of bony disproportion as well (see page 393). We will not pause to go into further detail for the literature is replete with description of the pathology which may be encountered.

We are convinced that the great majority of cases of primary cervical dystocia present the element of fibrosis as a cause or contributory factor. Occasionally, however, we note a delayed first stage in which history and findings seem to eliminate such an etiologic factor. There are three alternatives: first, that the delay is apparent rather than real and that the impression of retarded dilatation and effacement is due to exaggeration by the patient of the premonitory stages of labor; second, that the patient, through fear of pain consequent upon cervical pressure, is exerting a more or less voluntary resistance to descent; and third, that there may be an active spasmodic contraction of the cervix opposing dilatation. It will be possible to educe definite data to establish the first and second of the above mentioned alternatives by a study of the patient during her pregnancy and beginning labor, but we are not cognizant of factors which would determine a clinical diagnosis of spasmodic primary rigidity of the cervix. The reports (Tonef and others) of this type of rigidity present nothing tangible to elucidate such a diagnosis. The value of belladonna is far from proved, and certainly not sufficient to contribute toward the clinical evidence of the existence of a "spasmodic rigidity." The favorable effect of morphine in assisting dilatation is to be trusted only as evidence to exclude the presence of serious fibrous rigidity and points toward the likelihood of the existence of one of the first two above named general psychic factors. Its action is general and not local. By its use we treat the patient and not the cervix. As it is almost constantly used together with belladonna in the reported cases of "spasmodic rigidity," we ascribe the favorable effects noted due

to the general relaxing and analgesic effects of the morphine, and do not believe that the vaunted efficacy of the belladonna has contributed to substantiate the diagnosis of "spasmodic rigidity."

#### TREATMENT

*Prophylaxis.*—Nothing can be done to forestall the so-called congenital cervical atresias. An early knowledge of the condition, however, may help to avert serious later consequences both medically and socially. To this end, careful examination of those who show delayed menarche or notable dysmenorrhea is advised. The occurrence of vulvovaginitis, especially if the case has been neglected, should stimulate careful supervision during puberty. It is probable that many of the so-called congenital stenoses or atresias originate in a fetal or infantile inflammation of the cervical canal or lower ends of the Mullerian tubes. Vaginal atresias are frequently due to an early vaginitis. These sequellae do not occur where the vulvovaginitis or cervicitis is given the requisite attention (Taussig, Schauffler). The fact that such a condition has been treated, however, does not exclude the possibility of later stenosis or atresia. Unfortunately, too drastic treatment may increase rather than diminish the chances of subsequent scar tissue contracture.

Much of this paper is devoted to an exposition of the causal relation between measures intended to cure the ills of the cervix uteri and subsequent resultant stricture and occlusion. We reach the heart of the matter when we admit with Pinard that the treatment has too often been worse (in its late results) than the original disease. The reason for an apparent shortsightedness in this regard lies in a failure to understand or to admit the intrinsic nature of scar tissue. Incisions and cauterized areas may seem, even after many weeks, to have healed quite to the liking of the operator. It is only after months or years that the insidious contracture of the scar fibers makes itself apparent. Since it is difficult to follow the average case over a long period, we must accept the judgment of those who have been able to do this, and leave a wide margin of safety. Operation must be exact, and the probability of subsequent infection must be minimized. We must remember that curettage may cause scarring, especially in the region of the internal os, and that any type of rapid dilatation may cause tears with subsequent stenosis. The use of caustics should be strictly limited. Linear cautery should be used conservatively, and the picture of resultant scar contraction kept constantly in mind. Obstetric tears of the cervix should be repaired at once, but the sutures should be tied loosely to prevent pressure necrosis and in order not to hamper involution. Needless to say, all measures should be taken for the avoidance of tears. In this regard we need only stress the frequent warnings in regard to precipitate labors, "bearing down" on an undilated cer-



vix, high forceps, faulty application, manual or instrumental dilation, careless use of pituitrin, premature or ill-timed interference in breech presentations, and any form of "accouchement forcé." An important but frequently overlooked point in the prophylaxis of cervical tears is the control of precipitate labors. To this end, the intelligent use of induction at term, as outlined by Mathieu is of value. The method is almost universally successful in the case of multiparae calculated to be at term, and precludes the danger of precipitate labor at home or on the way to the hospital. The patient is always under hospital observation and anesthesia available to control very severe contractions. The ideal prophylaxis will consist not in the exclusion of procedures which might, with correct indications, be of value, but in the constant exercise of judgment in regard to the probable subsequent scar. *The margin of safety must be large.*

#### TREATMENT IN LABOR

*General Measures.*—Since we attach little significance to such classifications as "spasmodic" or "functional" cervical resistance, we may seem inconsistent in dwelling on methods of treatment which do not have as their object a definite attack on some actual resistance due to fibrosis or scar rigidity. We will admit that the use of general measures is directed only toward the production of analgesia, and a general relaxation and resting of the patient. For example, there is no local action of morphine or of rectal ether in oil upon the cervix, yet we frequently see an astonishing progress in dilatation consequent upon their use. We advise the use of such measures because they are uniformly helpful clinically, and because, even in cases of true rigidity, they may exert a generally favorable influence.

Expectancy is in itself a most important factor in the treatment of these cases; but it must be tempered by a thorough knowledge of the dangers of procrastination. The physical condition and temperament of the patient, the relation between the amount of outery and the severity of the contractions as judged by manual or bimanual examination, the condition of the fetus; these and other factors must be weighed against the failure of the cervix to dilate, in the determination of whether or not to intercede. The mental attitude of the patient, or of the patient's family must not be seriously considered as against the evidence of actual examination. We wish to condemn the practice of urging the patient to bear down before complete dilatation is accomplished, especially with primiparae. It may be necessary to exert considerable authority to prevent overzealous nurses or interns from urging this practice. It is pernicious and may actually defeat its own purpose if it does not cause other serious damage. The use of morphine, more often than not, accelerates the course of dilatation but it should not be employed until the labor is definitely in progress.

Also the effect on the baby should be taken into account. We have noted the most favorable effects in delayed dilatation following the use of morphine and magnesium sulphate followed by rectal ether and oil as advised by Gwathmey and Davis. Analgesia by nitrous oxide or ethylene is superior to that obtained by ether inhalations, but is hardly practicable in cases where the first stage is greatly prolonged. Chloroform should not be used in this way. Chloral hydrate, magnesium sulphate and other hypnotics by themselves are seldom of definite value. The use of atropine hypodermatically in doses of  $\frac{1}{100}$  gr. has its champions. (Ady, King.) Ady states that "it will as certainly dilate the os as it will the iris." King states that "its action occurs within twenty minutes and is to be relied upon." The use of belladonna both by mouth and locally to the cervix is a maxim of all the early writers and was recently advised by Tonef. Actually, however, we find few instances in the literature in which its value seems clear.

*Hot Douches and Bath.*—We mention the use of hot douches only to condemn them. They are scarcely more rational or safe than the much abused intrauterine douche of the last century. Both were widely used in an effort to assist dilatation of the cervix. A word, however, in regard to the complete hot bath should be said here. We were early impressed by the efficacy of this procedure as used by Cornell at the Chicago Lying-In Hospital. Where there is a strong nervous element especially with hysterical tendency, together with great fatigue, a half to an hour of immersion in warm water is of the greatest assistance in relaxing and quieting the patient. This effect is accentuated if the patient is under morphine. It is important to keep the thighs tightly crossed to exclude water from the vagina. We believe that this time honored measure should be used more often than it is.

*Bleeding.*—This procedure has been advocated since earliest times (La Chappelle, Mauriceau, Ashwell, etc.), from 10 to 30 ounces being withdrawn subsequent to labor. The favorable effect on a stubborn cervix seems to be analagous to the general relaxing effect of narcotics and sedatives, or the hot bath. Were it not for the efficacy of other methods in the treatment of cervical rigidity, and our inability to calculate how much the additional blood loss at delivery would be, we might still find a definite place for bleeding in our treatment.

*Bags.*—An attempt is frequently made to overcome cervical rigidity by the introduction of a conical bag and the use of weights. The mechanism of this procedure is unnatural and it seldom achieves the desired result. Furthermore, there is the added danger of infection and the increased tendency toward prolapse of the cord and later descensus due to the dragging down by the weights. That it is dangerous is attested by its mortality. We advise against its use in cases of true cervical rigidity. The following case is only one of many in which failure resulted in loss of time and a definitely less favorable prognosis.\*

Confinement Case 47650 New York Lying-In Hospital, Service of Dr. Kosmak. The patient entered at 11 P.M., December 1, 1920, with the history of escape of fluid, absence of fetal movements for past two days and weak contractions every 15 to 20 minutes. At admission there proved to be a breech presentation with no

\*This and subsequent case reports from the New York Lying-In Hospital are used through the courtesy of Dr. Asa B. Davis.

engagement. Fetal movements could not be felt nor the fetal heart tones heard. Position Right Sacro Anterior. Hard mass size of fist in left flank, suggestive of fibroid. Vaginal examination revealed cervix closed. Pelvis of medium size. There was marked rectocele. Cervix appeared to have been site of plastic operation (three years before). There was a firm ring of scar tissue with a small opening which admitted only a finger tip but could not be forced open by the finger. Pains increased to every three to five minutes lasting ten to fifteen seconds. Quarter grain of morphine was given at 11:30 P.M. The contractions gradually became more severe but at 4 P.M. on the following day (fifteen hours of active labor) there was no progress and the cervix remained unchanged.

*Former History.*—Patient was a para vi, having had two miscarriages, the first and third deliveries instrumental, the second a breech extraction. Previous pregnancy 3 years before resulted in a miscarriage. First labor fourteen years before. Operation three years before, nature not clear.

*Operation* (by Dr. McDonald under direction of Dr. Kosmak).—Patient in lithotomy position. Lips of cervix seized with tenacula but could not be brought down to vulva. Clamp inserted into cervix and the scar tissue ring dilated by opening the clamp. Several small incisions then made in cervix and dilatation to 2 fingers, thus obtained. No. 4 bag inserted and patient sent back to bed. At 9:30 P.M. (five hours later) there was no further dilatation of cervix despite strong pains with bag in place. Bag removed and radical bilateral incisions then made in cervix. Considerable foul smelling fluid escaped. One foot seized and breech extraction done slowly. Living baby. Placenta expressed easily. Uterus and vagina packed with iodoform gauze. Cervical incision only oozing. No sutures taken. Perineum intact.

Recovery was uneventful. Examination twelve days after labor showed perineum markedly relaxed with large rectocele. Cervical wound granulating, fairly clean crater. Cervical opening into vaginal vault one inch in diameter. The internal os, however, was closed. The fundus suggested the presence of fibroids.

We feel that the use of the bag in this case did not materially assist dilatation, but was a waste of valuable time, and increased the possibility of dangerous complications.

*Incisions.*—This procedure has been used to our knowledge since 1788 (Lauverjat). Dührssen (in 1890) advocated and popularized the use of several (generally three) incisions, and his name is at present used in this connection. Audebert is a well-known recent advocate. To justify the use of incisions in labor, it must have been clearly determined that the primary dystocia is in the cervix and that more dilatation is necessary than can be secured by a reasonable amount of stretching or that early delivery is essential regardless of the condition of the dilatation. With care, a moderate degree of dilatation may be obtained manually. The method of Harris is preferable. The use of mechanical dilators should not be undertaken. Quoting DeLee's textbook (page 965), "Most so-called manual and instrumental dilatations of the cervix are in reality bilateral incisions or tears, but made with blunt instruments." To this end, it is wiser, if further dilatation is required, to make several incisions, whose total relaxing effect will allow free passage of the uterine contents. The danger of

incising the cervix prior to effacement has been pointed out since the earliest use of the operation. Extension is to be feared and hemorrhage is more likely to occur, due to nonretraction of cervical vessels. Audebert and Rascol are not impressed by these dangers, but for the majority, effacement is an absolute essential to the safe and successful use of incisions. It is our practice to make "Dührssen's" incisions as advised by DeLee (at points 2, 6 and 10 corresponding to the clock face), estimating the depth necessary to allow passage of the head, but generally to the vaginal fornix. We have never encountered serious bleeding, have had no alarming extensions, and have generally been able to judge correctly the depth of incision necessary. The use of sponge forceps to draw down the lips will minimize trauma and assist in the performance of the operation under vision. The tension in the region of the incisions should be noted digitally as far as possible during extraction or spontaneous delivery.

Vaginal cesarean section as described by Dührssen may be the operation of choice, where effacement has not taken place. It is in all respects a major surgical procedure, and increasingly so as the duration of the pregnancy approaches term. The technic of the operation will not be discussed here. Care must be taken to allow room for the passage of the uterine contents. A posterior incision should always be made if there is any question of sufficient dilatation. Hemorrhage may be a serious complication, but as a rule, mid-line incisions will involve the less vascular areas.

Any incision should be carefully sutured, but the sutures tied lightly. Postpartum examination in these cases should be thorough, and the patient should be kept under observation as long as possible. There is always additional danger of cervical dystocia in subsequent labors, due to the initial pathology plus the contractile effect of the healed incisions. If incision is necessary to effect dilatation in a cervix which is scarred only in certain areas, the incision should be made in the healthy tissue away from the distortion, except where the simple cutting of a band or knob may be sufficient to allow dilatation to proceed.

Cesarean section is occasionally indicated, due to an extreme degree of scarring with danger of rupture of the uterus or adjoining viscera. In elderly primiparae particularly where a considerable extent of the canal is occluded, section is often necessary. Complications such as a vicious presentation or associated contracted or deformed pelvis will complete the indications for section. In urging a careful follow-up and report of these cases, the authors wish to point out that in cases coming to section, and especially those in which low cervical or Porro section is done, an excellent opportunity is offered for a careful study of the nature and degree of the stenosis from above. This should be carried out digitally, instrumentally, and visually where

possible, with the greatest care. There can be no case of this kind, which if conscientiously studied, will not be of definite value in the literature.

#### SUMMARY

*Etiology.*—The great frequency with which fibrosis occurs as the cause of true primary cervical dystocia is indicated. Conclusive evidence of the presence of continuous circular fibers (sphincteric type) is not forthcoming. It seems that ordinarily the caliber of the canal is maintained passively by the anatomic conformation of the organ as in the case of other nonsphincteric orifices. Doubt is cast upon the existence of such a condition as "spasmodic cervical contraction" during labor. In cases where such a diagnosis has been most frequently made, there are very often psychic or other general factors which, on careful analysis, will prove to be the actual cause. Other factors which may occasionally cause a cervical dystocia are discussed: syphilis, displacement of the os, adhesive membranes, overlapped cervical lips, etc. The condition called "*Conglutinatio Orificii Externi*" is considered.

*Diagnosis.*—In the diagnosis, extracervical factors must be eliminated and fibrosis should always be suspected. In its absence, the most frequent factors causing an apparent cervical dystocia are (1) a misinterpretation of the patient's reaction to the very early stages of labor, giving the impression of prolonged labor without commensurate cervical change. (2) Active voluntary resistance to descent occasioned by the pain consequent upon pressure on the cervix.

*Treatment.*—If an apparent cervical dystocia is not due to fibrosis, the most favorable results will follow watchful expectancy and the advised use of sedatives. Such methods will decrease in efficiency in direct proportion to the degree of scar tissue involvement, but may be helpful in any case. The use of bleeding and the warm bath is discussed. The insertion of weighted bags where fibrosis is a factor is condemned. Manual dilatation is seldom advisable, and instrumental dilatation never. The correct use of incisions is advised and described. Vaginal and abdominal cesarean section are discussed.

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MEDICAL ARTS BUILDING.

## INTERNAL ROTATION OF THE HEAD WITH REMARKS ON THE KIELLAND FORCEPS\*

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IT IS generally taught that the head enters the pelvis in one of the oblique or the transverse diameters of the pelvic inlet, and during its passage through the birth canal the occiput rotates in one direction until it comes directly anterior or rarely directly posterior. If it enters with the occiput anterior or transverse, the rotation is forward through an arc of 45 or 90 degrees. If the occiput is posterior the rotation is forward through an arc of 135 degrees, or rarely posterior through an arc of 45 degrees.

The frequency with which heads are found directly transversely, regardless of the original position whether anterior or posterior, is very striking. Careful observation by vaginal examination is convincing that the head will pass through this position during labor. The level at which this occurs is that of the ischial spines or the plane of the least pelvic dimensions. So far I have been unable to explain just why this occurs. However if this is true, and I believe it is, the mechanism must be as follows:

*Occiput Anterior.*—The head enters the pelvis in one of the oblique diameters of the pelvis, and during its passage from the inlet to the spines the occiput rotates posteriorly through 45 degrees to the trans-

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verse position, and then in its further passage to the outlet, rotates anteriorly through 90 degrees to bring the occiput under the symphysis.

*Occiput Transverse.*—The head enters the pelvis in the transverse with the occiput directed to the left or right (noticeably in flat pelvis), and continues in this position during its descent to the spines and then rotates anteriorly through 90 degrees as it reaches the outlet.

*Occiput Posterior.*—The head enters the pelvis in one of the oblique diameters with the occiput posterior, and during its descent to the level of the spines rotates forward through 45 degrees to the transverse position. In its further descent it either rotates forward through 90 degrees to bring the occiput under the symphysis or rotates posteriorly through 45 degrees to its original position in one of the oblique diameters. If the latter occurs and labor ends spontaneously the occiput rotates anteriorly through 135 degrees or rarely posteriorly through 45 degrees to the hollow of the sacrum.

The generally accepted explanation for the mechanism of rotation is that this process is either due to the resistance of the levator ani muscles forcing the head to turn; or that the child, acting as a cylindrical body that can bend readily only in one direction, is forced through the pelvic canal as through a curved tube. Here the most pliable portion, which in the case of the child is the neck, adapts itself to the curvature of the pelvic canal by extension, thus bringing the occiput forward. If this is true, rotation is the result of descent, and the arrest of one causes the arrest of the other. In other words, in cases of dystocia the lack of descent is the primary factor and the lack of rotation secondary. Thus if descent is aided, rotation should follow of itself and seemingly it does so in many cases. The cases we are most frequently called upon to assist instrumentally are the deep transverse arrest cases of DeLee, i.e., where the head is at, or slightly below, the level of the spines with the sagittal suture transversely, or where the occiput is posterior with sagittal suture in the oblique position and the head below the spines. The deep transverse arrest always occurs where the descent is hindered by a funnel pelvis, or very prominent ischial spines, or an immobile coccyx. Occiput posterior rotation most frequently occurs in funnel pelvis, and descent is hindered, in addition, by the poor flexion of the head usually present, offering a larger diameter for passage. Traction alone by forceps on a head in the transverse will very frequently result in spontaneous rotation of the head when it reaches the point where it would normally rotate, i.e., the pelvic floor. The same is true, but to a lesser degree, with the occiput posterior. Thus it seems as if our efforts in delivery in unrotated heads should be primarily aimed to assist descent and only secondarily rotation. There are, of course, many cases where the rotation must be deliberately done.

Effecting delivery in this manner is most easily done by the use of a straight forceps or the one devised by Kielland in 1915 and used rather extensively in Europe but less so in this country. Its chief advantages are its very slight pelvic curve and the sliding lock which make a correct cephalic application much easier and more certain than in the forceps with a pelvic curve and fixed lock. The perfect cephalic application and the traction in the axis of the child and the pelvis, which is possible without a pelvic curve of the instrument, seem to make the spontaneous rotation more apt to occur when traction is applied, and if it does not occur of itself is more readily accomplished. With the occiput posterior the very slight pelvic curve frequently makes possible the application with this slight curve toward the occiput and the delivery with a single application of the forceps instead of the double application of the Scanzoni maneuver or its modification by Bill. It is claimed that the Kielland forceps decreases the chance for injury to the child's head and the mother's soft parts. This seems to be true because of the correct cephalic application that is easier to obtain and because delivery apparently can be completed with less traction, since it is exerted directly in the axis of the child and not off center as is the case when the forceps has the usual pelvic curve.

For a very clear and comprehensive description of the forceps, its uses, advantages and technic of application the reader is referred to Jarcho's article in the *American Journal of Obstetrics*, Vol. x, p. 1. At first reading, the description of the application of the anterior blade upside down and then turning it over seems extremely dangerous, but after using the procedure one is convinced that it is perfectly safe, provided no force is used. The turning of the blade is surprisingly easy and if not it can still be introduced as the ordinary forceps. When the head is high, it is more difficult to apply the anterior blade by the Kielland technic.

#### CONCLUSIONS

The head during its passage through the birth canal rotates to the transverse position at the level of the plane of the least pelvic dimensions regardless of its original position.

Since descent is primary and rotation is secondary, assisting descent by traction should cause rotation to occur, and it does in many cases if a straight forceps is used.

The Kielland forceps with its very slight pelvic curve and sliding lock is the most satisfactory and offers advantages that make its use on unrotated heads desirable.



## THE PHENOLTETRACHLORPHTHALEIN TEST OF LIVER FUNCTION IN THE LATE TOXEMIAS OF PREGNANCY

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THE Rosenthal test of liver function was undertaken three years ago with the hope of finding some method which would throw additional light on the various forms of the late toxemias. Clinically it is most difficult to differentiate the nephritic and preeclamptic types of toxemia. Harris<sup>1</sup> does not attempt to classify the late toxemias until three weeks following the termination of pregnancy where the criterion is the presence or absence of renal involvement. In no case was it felt that a conclusive diagnosis could be reached before the expiration of this period, except in patients who died and came to autopsy. Plass<sup>2</sup> also agrees that it is almost impossible to differentiate the two types and after extensive studies of the blood chemistry concludes that such studies are at present of little or no aid in the clinical management of these cases and that the older methods of examination, namely, urinalysis, blood pressure readings, and ophthalmoscopy yield the most valuable information concerning the patient's condition. Our experiences, having coincided exactly with theirs, we turned to the study of the excretion of phenoltetrachlorphtalein seeking for a new source of assistance on this problem.

Autopsy findings usually show fairly extensive liver damage in the eclamptic group. Consequently the theory was proposed that in this group, retention of dye should be found, and very little or no retention in the nephritic. Rosenfield and Schneiders<sup>3</sup> conclude that the test is a more accurate index of existent toxemia than variable clinical symptoms, and that it may be possible by means of it to anticipate the clinical picture in forming an opinion as to the degree of toxicity existent at a given time. They further state that it will aid greatly in serving as an index of treatment and assist in determining the time at which a therapeutic abortion or induction of labor should be performed. Krebs and Dieckmann<sup>4</sup> also think that this test offers considerable promise in the management of the toxemias. Smith<sup>5</sup> feels that more time is needed to form a reliable opinion as to the true value of the test. He believes, however, that the more severe cases show retention and that they are of the preeclamptic type rather than of the nephritic. King<sup>6</sup> believes that it is of service in differentiating between the nephritic and preeclamptic types of toxemia, and that the degree of retention seems to correspond with the clinical findings.

The method employed is essentially that described by Rosenthal.<sup>7</sup> Five-tenths milligram of the dye per kilo of body weight is injected intravenously. Care must be taken to prevent any from entering the tissues, since an alteration in the correct result of the test may thus be brought about. The best method of injecting the dye is by means of a three-way stopcock arrangement, washing the syringe out carefully with normal salt solution. Specimens of blood are collected preferably from the other arm at fifteen minute, one hour, and two hour intervals. Dissolved hemoglobin interferes with the readings, so dry needles or those boiled in salt solution should be used. The blood should be allowed to stand until the clot has reacted. The blood serum is then alkalinized with 5 per cent NaOH and the resulting colors are compared with standards in a comparator. Smith has found that in normal pregnancy 3 to 5 per cent of the dye is recovered in the fifteen minute interval, a trace to 1 per cent at the end of an hour, and nothing to a trace at the end of two hours. The limit of normal may be considered 7 per cent after fifteen minutes, 3 per cent at the end of an hour, and a slight trace at the end of two hours. Ottenberg<sup>8</sup> and his colleagues have noted that 5 per cent in the hour specimen may be considered a suspicious sign of liver impairment, while 8 per cent or more is conclusive.

The test has been used on 118 cases. Forty-four of these have been previously reported.<sup>5</sup> No classification into nephritic and preeclamptic groups has been attempted, and only those with convulsions have been separated. Of these 118 cases, 34 showed retention of the dye in varying amounts, 84 had none. In the group with retention 9 died, in the other group, 3 died. There were 20 with convulsions, 10 having retention, and 10 without any, and 3 in each group died. Such parallel figures in the group with convulsions are indeed surprising. As far as we can tell, none among these had a history of previous chronic nephritis and consequently cannot be classified as a chronic nephritic with convulsions.

Inasmuch as the occurrence of convulsions is the terminal event in either group, it is felt that a more accurate and satisfactory conclusion can be reached by confining our analysis to this group. In the group without convulsions most of the cases with retention have been sent to us in a neglected state, having had either no treatment or at best very inadequate, while a large percentage of the group without retention has been watched carefully in the prenatal clinic and sent into the hospital at the early appearance of symptoms, and in a large number the test has been performed many days before delivery. In the convulsive group, however, most of the patients have come to us in the eclamptic state, and the test has been done just before or following the onset of convulsions. Therefore, it seems that this group should offer us a much more correct estimate of the value of this test.

On careful analysis of the cases, one is immediately impressed by the similarity of symptoms, blood pressure elevation and albuminuria, and if the result of the response to phenoltetrachlorphthalein were unknown, it would be impossible to differentiate them. In the group with retention, 5 had convulsions antepartum, and in 5 labor was induced. The amount of retention seems to be no index of the severity of the disease. Case 32133 (Table I), was the least sick of any, yet here was a greater amount of dye retention than any other excepting one which was fatal, Case 29961. Greene<sup>9</sup> and his coworkers believe that readings of at least 10 per cent at fifteen minutes, 5 per cent at the hour, and 3 per cent at the two hours are required before they can be significant of hepatic disturbance. Eight cases had retention of 5 per cent or more at the hour period, and 8 showed 3 per cent or more at the two hour reading, but only 3 had 10 per cent or more at the hour and only 2 had 6 per cent or more at the two hour interval. Thus in most of the cases the amount of retention was not large.

The possibility of dye retention prognosticating the occurrence of convulsions is indeed interesting and if correct, would be of great value, but our hopes have not been realized. Unfortunately in most of the cases, convulsions had set in before this test was done, yet there are a few in which it was recorded prior to their occurrence. Case 30737 (Table II) was six months' pregnant and entered with a blood pressure of 180 and a large trace of albumin. There was no retention. Six hours later she complained of epigastric pain. A bag was inserted at once, and three hours following this she had a convulsion. Case 32083 was six months pregnant and entered with a blood pressure of 160, a large trace of albumin, and considerable edema. She appeared listless and apathetic. There was no retention of dye. The next morning without any prodromal warning she had a convulsion. Case 31827 entered in labor with partial separation of the placenta. She was close to term with a blood pressure of 132 and a large trace of albumin, complaining of headache and blurred vision. Since her vagina had been packed with unsterile cotton before entrance it was deemed inadvisable to deliver by cesarean section, so a Voorhees bag was inserted. There was no retention of dye. Five hours later she had a convulsion. Case 32189 (Table III), entered in labor and was delivered of a normal full term baby. She had moderate retention. Three days later she had a convulsion. This was the only case with retention known before delivery in which convulsions took place.

Two cases of postpartum eclampsia add to our difficulties in evaluating this test. They entered the hospital at nearly the same time, had almost identical histories and clinical courses, and similar endings, but one had retention of the dye and the other had none. Case 32058, trigravida, aged twenty-seven, had two previous normal pregnancies.

TABLE I. ECLAMPTICS WITH RETENTION

CASE NO.	AGE	PREVIOUS PREGNANCIES		MONTH	SYSTOLIC BLOOD PRESSURE	ALBUMIN IN URINE	SYMPTOMS	DYE RETENTION			TIME IN RELATION TO DELIVERY	COMMENT
		GRAV.	MISC.					15"	1'	2'		
29961	41	6	0	8	180	l.t.	Admitted in convulsions	9 12	13 18	13 16	1 hour before 6 hours before death	Voorhees bag. Low for- ceps. Died 72 hours after delivery in coma and jaundiced.
31115	29	3	0	7	170	l.t.	Headache, stupor, edema. One convulsion before delivery	4	3	2	4 days before	Voorhees bag. Well.
30407	37	5	0	Term	220	l.t.	Great edema, stupor, head-ache, blurred vision. One convulsion	10	10	4	Few hours before death	Voorhees bag. Died undelivered.
30504	18	1	0	Term	150-220	l.t.	Convulsions 4 hours after delivery	12	9	3	4 hours after delivery	Breech extraction. Well.
30744	34	9	1	6	180	l.t.	Marked edema, blurring of vision. Three convulsions	6 6 4	tr 6 tr	0 5 0	15 days after 1 hour before 18 days after	Vaginal hysterotomy. Well. Previous toxemia with convulsions.
30979	26	1	0	Term	145	s.t.	Convulsions 1 hour after delivery	8 tr	6 0	3 0	1 hour after 5 days after	Well.
32058	27	3	0	Term	210	l.t.	10 convulsions after delivery	10	8	5	14 hours after	Twins at home. Convulsions 12 hours later. Died.
32133	38	8	0	Term	120	s.p.t.	One convulsion during labor	10	13	11	1 hour before	Well. Had toxemia in previous pregnancy.
32180	27	3	0	7	110	l.t.	Headache, blurred vision, vomiting. 3 convulsions before delivery	10	3	1	4 hours before	Induced with bougie. Well.
32189	34	6	0	Term	170	l.t.	Convulsions 3 days after delivery	12	9	3	1 hour before	Well.

TABLE II. ECLAMPSIA WITHOUT RETENTION

CASE NO.	AGE	PREVIOUS PREGNANCIES		MONTH	SYSTOLIC BLOOD PRESSURE	ALBUMIN IN URINE	SYMPTOMS	DYE RETENTION			TIME IN RELATION TO DELIVERY	COMMENT
		GRAV.	MISC.					15"	1'	2'		
30553	23	1	0	Term	130-200	l.t.	Convulsions 12 hr. after delivery	4	2	0	24 hours after	Well
30737	38	5	1	6	220	l.t.	Epigastric pain. One convulsion	6	tr	0	1 day before	Vaginal hysterotomy. Died 24 hours later
31370	25	1	0	7	168	l.t.	Several convulsions before entrance	4	0	0	1 day before	Induced with bougie. Well
31393	17	1	0	Term	158	l.t.	Two intrapartum convulsions	6	tr	0	1 hour before	Well
31705	39	5	0	Term	240	l.t.	6 convulsions before delivery, 2 post-partum	3	1	tr	2 hours before	Well
31827	21	1	0	Term	132	l.t.	Headache. Blindness. Separation of placenta. One convulsion before delivery	5	2	tr	7 hours before	Voorhees bag. Well
32063	19	1	0	Term	178	l.t.	Headache. One convulsion postpartum	6	1	0	4 hours after	Well
32071	29	2	0	Term	118	l.t.	Normal delivery at home. 10 convulsions after delivery. Headache and blurring of vision	6	1	tr	12 hours after	Died 30 hours after delivery
32063	20	1	0	6	160	l.t.	Headache. Much edema. One convulsion before delivery	6	1	0	1 day before	Induced with bougie. Well
								5	3	2	1 hour after	
32384	30	2	0	Term	180	l.t.	Separation of placenta. Five convulsions before delivery	10	5	tr	2 hours before	Induced with Voorhees bag. Quick easy delivery. Died 12 hours later of shock

She was delivered of her third at home. Eight hours later she had a convulsion, and four more before entrance to the hospital. On admission she was comatose, had a blood pressure of 210, and a very large trace of albumin. Here she had five convulsions and died of pulmonary edema and myocardial failure nineteen hours after entrance. She had a reading of 10-8-5. Case 32071, secundigravida, aged twenty-eight, had one previous normal pregnancy. She was delivered of her second at home. Seven hours later she had a convulsion and three more before entrance to hospital. She was comatose, had a blood pressure of 118, and a very large trace of albumin. Here she had three convulsions and died of pulmonary edema and myocardial failure eighteen hours after entrance. There was no retention of the dye. Both cases were treated in the same manner. Autopsy in each case showed about the same pathologic picture. The liver had areas of peripheral necrosis, and the kidneys showed evidence of an acute tubular nephritis. The first had a blood nonprotein nitrogen of 30 and uric acid of 8; and the second had a nonprotein nitrogen of 26 and uric acid of 8. The parallelism of these two cases is striking, yet why one should show retention of the dye and the other have none is difficult to explain.

The differentiation of the preeclamptic and the nephritic by the presence or absence of dye retention would be of major significance and would firmly establish this test as a routine procedure. The majority of chronic nephritides show no retention. Yet some in whom retention had been demonstrated have returned with evidence of a nephritis. Sixty-one cases have been seen in a period from six months to two years following delivery. Careful records have been kept of their blood pressure readings and urinary findings. Forty-six were in the nonretention group and 19, 41 per cent, showed blood pressure elevation or urinary changes or both. Fifteen were in the other group and 5, 33 per cent, proved to be abnormal. The number of cases is small and the method of classification clinical. No elaborate chemical studies have been attempted. But the trend of affairs seems to be fairly well indicated. Of course, it is not known whether the nephritis has been the underlying cause of the toxemia or originated as a result. Much further investigation is needed to settle that question. Thus far, however, the presence of dye retention has not appreciably reduced the percentage of patients with signs of nephritis.

Twenty-six patients in this series have returned with another pregnancy. These have been watched with great interest. Of 6 who had shown retention previously, 5 had no symptoms. One had a mild toxemia and was delivered of a full-term living child. She had no retention this time. Twenty had had no retention. Six of these were normal, although one had a premature baby at seven and one-half months. She was free from toxic symptoms. Of the remaining 14, 3 who had had hyper-



TABLE III.—CONTINUED

CASE NO.	AGE	PREVIOUS PREGNANCIES		MONTH	SYSTOLIC BLOOD PRESSURE	ALBUMIN IN URINE	SYMPTOMS	DYE RETENTION			TIME IN RELATION TO DELIVERY	COMMENT
		GRAV.	MISC.					15"	1'	2'		
30737	38	5	1	6	220	l.t.	Epigastric pain. One convulsion	6	tr	0	1 day before	Vaginal hysterotomy. Died 24 hours later <i>Autopsy:</i> Slight peripheral hemorrhages and slight central necrosis of liver
30824	25	1	0	Term	160-180	l.t.	Slight edema	11	10	8	2 days before	Voorhees bag. High forceps. Died 9 days later of septicemia <i>Autopsy:</i> Mild toxic degeneration of liver with slight central necrosis
31963	39	9	0	8	220	l.t.	Headache, nausea, vomiting, blindness of left eye	5	3	1	10 hours before	Induced with bougie. Died in coma 4 hours after delivery <i>Autopsy:</i> Peripheral necrosis of liver and acute tubular nephritis
32058	27	3	0	Term	210	l.t.	10 convulsions 12 hours after delivery	10	8	5	14 hours after	Twins at home. Died 30 hours later <i>Autopsy:</i> Peripheral necrosis of liver and acute tubular nephritis
32071	29	2	0	Term	118	l.t.	10 convulsions after delivery	6	1	tr	12 hours after	Normal delivery at home. Died 30 hours later <i>Autopsy:</i> Peripheral necrosis of liver and acute tubular nephritis
32268	26	1	0	Term	240	l.t.	Edema, headache, blurred vision	12	8	4	24 hours before	Induced with bougie and bag. Version. Died in coma 24 hours later
32384	30	2	0	Term	180	l.t.	Several convulsions before entrance	10	5	tr	3 hours before	Separated placenta. Voorhees bag. Normal delivery. Died in coma 12 hours later <i>Autopsy:</i> Peripheral necrosis of liver and acute tubular nephritis





TABLE IV—CONT'D

SECOND ADMISSION													
CASE NO.	GRAV.	MONTH	SYSTOLIC BLOOD PRESSURE		ALBUMIN IN URINE	DYE RETENTION	RESULT	MONTH	SYSTOLIC BLOOD PRESSURE		ALBUMIN IN URINE	DYE RETENTION	RESULT
			15"	1' 2"									
No Retention of Dye													
31842	i	8	170		s.p.t.	6 2 xtr	Premature labor; well	Term	160		s.t.	No retention	Well
31603	i	Term	154		0	5 2 0	Well	Term	150-160		0	No retention	Well
31827	i	8	132		l.t.	5 2 0	Separated placenta. One convulsion. Voorhees bag	Term	150-170		s.t.	No retention	Well
32335	i	Term	170		0	3 0 0	Well		170		0	No retention	No symptoms
30104	i	8	150-160		t.	7 3 0	Well	Term	138		t.	Not done	Well; twins
30349	i	8	170-180		s.t.	5 2 0	Voorhees bag; well	Term	120		0	Not done	Well
32168	ii	8	140		t.	10 2 1	Diabetic induced with bougie; well	8	180		s.t.	No retention	Voorhees bag; well
30607	iii	Near Term	240		t.	7 2 0	Voorhees bag; well	4	190		0	Not done	Miscarried; chronic nephritis
30435	i	Near Term	140		s.t.	4 tr 0	Twins; well	Near Term	160		s.t.	Not done	Voorhees bag; well
30748	i	8	150		l.t.	5 2 0	Voorhees bag; well	Term	140		t.	Not done	Well
32065	x	8	170		l.t.	3 1 0	Chronic nephritis	Term	180		l.t.	Not done	Induced with bag
31033	i	Term	150		s.p.t.	4 1 0	Well	6	170		s.p.t.	Not done	Macerated fetus; chronic nephritis
32166	i	7	135		l.t.	4 2 0	Much edema; well	7	170		l.t.	Not done	Antepartum convulsions. Macerated fetus

tension as the only symptom reacted similarly in the second pregnancy. Three were definitely known chronic nephritics. Case 30427 (Table IV) had miscarried at five months with a most severe toxemia. She was just as sick this time at the same period, and was aborted and sterilized. Case 30607 in whom labor had been induced close to term, miscarried at four months with a blood pressure of 190. In Case 31865, labor was induced at eight months and a living premature baby was born. Eight had a recurrence of the toxemia. In 6 it was less severe than in the preceding pregnancy. One had convulsions at the seventh month, and one who previously had gone to term with a mild affair delivered herself of a macerated fetus at six months.

From the above series, one gathers the impression that those patients in whom a retention of the dye was found to go through a succeeding pregnancy without any repetition of toxemia. Only one among them had any difficulty, and it was minimal. In the nonretention group, however, the majority failed to have smooth sailing. Of the three chronic nephritics one miscarried, one was aborted, and one had a living premature baby. This finding coincides with the known small possibilities of chronic nephritics securing live babies. The three with hypertension withstood this pregnancy better than the first. Case 30472 went to full term this time, whereas before she went into labor prematurely at seven months. She has again reached term without any other symptom than a blood pressure of 150. Case 31603 has recently completed her third pregnancy at full term without any untoward symptoms. Her blood pressure ranged between 130 and 138, lower than her two previous pregnancies. Among the 8 pregnancies with a recurrence of toxemia, labor was induced in two close to term. Four went into labor spontaneously at full term. In these six, the toxemia was of less severity than in the previous pregnancies. This is most likely due to the careful prenatal supervision. Case 32166 who returned with convulsions had no prenatal care. She cleared up very quickly and now shows no residual symptoms. Following her first pregnancy, we were unable to classify her. She failed to return for further study, but on discharge from the hospital, her blood pressure was 130 with a trace of albumin in the urine. Case 31033 was delivered of a living baby at term. About a month before delivery, she had a blood pressure of 150 and a s.p.t. of albumin. She was sent into the hospital, and responded well to treatment. She was then followed in the antenatal clinic until delivery. Her blood pressure and urine returned to normal a few days postpartum and she was well on discharge. She did not come back until pregnant again at six months with a blood pressure of 175 and a trace of albumin. She was immediately sent into the hospital and remained about the same for two weeks when suddenly the baby ceased moving and she was delivered of a macerated fetus. Nearly half of the placenta was in-

farcted. Among the 8 patients who had a recurrence of toxemia this seems to be the only one who probably has nephritis. The others have a faulty kidney reserve without doubt and show no disturbance of function when not pregnant. Whether the eclamptic has an underlying nephritis is difficult to say.

Of the 20 with retention, 14 had symptoms of toxemia. One eclamptic and three nephritics failed to attain their goal, a living baby. The others succeeded. But did they unduly risk damaging their kidneys seriously? Two of the three with hypertension have had their third pregnancies and seemingly have improved each time. Six of the 8 with a recurrence of toxemia had a milder course than before. One developed eclampsia and one nephritis. Possibly the kidneys will not endure the strain in the next pregnancy and other nephritics will be added to the list, or they will bear up well and nothing happen. The question cannot as yet be answered. But it does seem that this nonretention group harbors by far the greater number of potential nephritics.

Before passing final judgment on the value of this test, it must be borne in mind that the liver has many functions. It is also an organ with a large factor of safety, inasmuch as a goodly portion can be removed without causing any noticeable disturbance in function. Rosenthal<sup>10</sup> has found that 12 per cent of liver substance in rabbits can be removed before the occurrence of any retention. Its reserve power is also very large. An animal can live on 30 per cent of the normal amount of liver tissue. The complexity of hepatic function makes it appear evident that this dye is by no means capable of measuring it as a whole. There is yet no known test which has this ability. In any disease of the liver it is most unlikely that all the functions are deranged or at least equally involved. Retention of the dye does not necessarily indicate a deficiency in the performance of the normal metabolic functions of the liver. Only the excretory power of the liver is measured, and there must be a variation in the excretory power of different individuals. Consequently, one must be guarded in his conclusions.

Another factor to be carefully considered is the acuteness of this disease. The prevailing view is that some toxin engendered in the placenta is the causative agent of toxemia. The severity of symptoms is governed by the amount of toxin liberated. Undoubtedly a large amount of this substance can be freed in a short space of time, or there can be a cumulative action. There are numerous people showing mild symptoms for a short time, who suddenly become overwhelmed. Again there are many others running along smoothly and normally who without any warning grow desperately sick. The rapidity of the change is remarkable. Equally swift are the variations in the amounts of dye retention. Patients with no retention may develop a fairly large amount in forty-eight hours. Likewise, nearly all with retention return to

normal in two to seven days after delivery. A few cases have had diminished amounts of retention at weekly intervals. Probably in no condition are more striking changes encountered. The experimental work of Lamson and McLean<sup>11</sup> on the toxicity of carbon tetrachloride is probably a very good example of the action of this toxin and the response of the liver to it. Four c.c. per kilo of carbon tetrachloride given by stomach tube to dogs produced a functional change in forty-eight hours and gave the following curves with phenoltetrachlorophthalein: (1) 9-6-6, (2) 15-10-8, (3) 12-7-6. In ninety-six hours the animals recovered and there was no retention. This shows the tremendous ability of the liver to maintain its normal equilibrium. Smaller and divided doses of this substance caused no symptoms and no retention. Among our cases are many comparative results. Perhaps many with no retention would have shown some a few days later had the pregnancy been permitted to continue. A large number of our cases were discovered early and the pregnancy interrupted. This may partly explain the preponderance of negative tests.

#### DISCUSSION

The Rosenthal test has been performed on 118 cases of toxemia. In 34 varying amounts of dye retention have been found. In the majority, the amount of retention has not been large. The most significant observation is the presence of 10 eclamptics with retention of the dye and ten with none, 3 dying in each group; and the striking similarity of symptoms, hypertension, and albuminuria. The presence or absence of the dye seemed to have no particular effect nor caused any fundamental differences.

A mortality of 9 in the retention group versus 3 in the other, however, is noteworthy. Two died of sepsis and should therefore be ruled out. Three died of eclampsia. Of the remaining four, Cases 31963 and 32260 (Table III) were moribund on entrance, each having had alarming symptoms for some weeks. They can be classed as badly neglected. The former had practically no retention, the latter only a moderate amount. Case 30224 was watched carefully, having had toxemia in a previous pregnancy. One month before delivery, she entered the hospital complaining of severe epigastric pain with a blood pressure of 168/68 and a large trace of albumin with many hyaline and granular casts. Liver function test was practically normal. She improved rapidly and eleven days later was discharged with a blood pressure of 110, a negative urine, and no symptoms. Eleven days later the blood pressure was 118, the urine contained a trace of albumin, and there were no symptoms. A week later, there was no change. Five days after this, she entered hospital again because of steady, severe epigastric pain which she had had for about six hours together with nausea, moderately severe headache, and slight blurring of vision. Blood

pressure was 180, and the urine contained a large amount of albumin. The liver function test showed some retention at the hour period, but only a slight trace at the two hour. A Voorhees bag was inserted and in three hours she was delivered of a normal living baby. About half of the maternal surface of the placenta was dark brown and necrotic looking. She bled more than a normal amount after delivery, but appeared in good condition. About a half hour after delivery, she went into severe shock and died three hours later. Autopsy showed a peripheral hemorrhagic necrosis of the liver and acute tubular nephritis.

Case 30674 presented herself at the clinic for the first time, seven months pregnant, with a blood pressure of 134 and a slight trace of albumin. There was no elevation of blood pressure, but an increasing albuminuria. She had no other symptoms until eighteen days following her first visit to the clinic when she noticed a sudden development of edema of the face, vulva, and extremities. The blood pressure now was 150/90, and there was a large trace of albumin with many granular and hyaline casts and numerous red blood cells. The liver function test showed a reading of 5 at the hour and 2 at the two hour. The next day, she was very lethargic and the abdomen badly distended. The blood pressure crept up to 160/110. Five hundred c.c. of blood were withdrawn without any apparent effect. The liver test was 4 at the hour with only a trace at the two hour. The output of urine had greatly diminished. She was worse the following day and was delivered of a living baby by vaginal hysterotomy under ether anesthesia. She was transfused with 500 c.c. of citrated blood and 500 c.c. normal saline. There was almost complete anuria, and the next day she was transfused again with 500 c.c. of citrated blood without avail. The anuria was now complete and in twenty-four hours she died. The reading at the hour was 9, the two hour was not taken. Autopsy showed an acute tubular nephritis and a central necrosis of the liver.

In both of these cases there was no significant amount of retention before delivery, and in the second there was a moderate amount just before death. In neither, at the autopsy, was found any particular degree of liver damage and no evidence of chronic nephritis.

In this entire series the amount of dye retention has been no index of the severity of the diseases and surely has had no prognostic value. The absence of dye retention has not allowed us to feel secure about the occurrence of convulsions, in fact, the reverse was the more usual. It is true that in the non-retention group the largest number of chronic nephrities are gathered, yet in the retention group, 33 per cent on further study showed evidence of nephritis versus 41 per cent in the other. The small number of cases may account for the seeming closeness of the percentages. In subsequent pregnancies, however, those with retention made by far the better showing, only one out of six manifest-

ing any symptoms of toxemia. In the other group were 20 cases. One known chronic nephritic necessitated abortion at the fifth month, another miscarried at the fourth month, and another was delivered of a living premature baby. Three with hypertension as the only symptom acted similarly, and two of the three have had third successful pregnancies and have appeared to be in better condition than with the first. Six were perfectly normal, although one had a premature baby at seven and one-half months. Eight had a recurrence of toxemia. In six, it was of a less severe nature than in the preceding pregnancy. One had convulsions and a macerated fetus at 7 months, and the other passed a macerated fetus at 6 months with a blood pressure of 175 and a trace of albumin. This is the only case out of the eight which can be classed as a nephritic. The others undoubtedly have a deficient kidney reserve, but at present cannot be thought of as nephritics. They may be potentially more liable to develop this condition, but fall into the low reserve kidney group described by Stander and Peekham.<sup>12</sup>

It is worthy of noting that inasmuch as 60 per cent of eclamptics are primiparae, 6 out of 10 are present in the nonretention group and only two in the other. Possibly we are overemphasizing the hepatic factor and should turn more to the renal. But it must not be forgotten that this test must be repeated very often on account of the quick changes of this disease, and that there are variations in the reactions of different individuals. Besides, it is only the excretory index of the liver for this particular dye. It seems that one would be assuming too much to state without reservations that this test differentiates the pre-eclamptic from the nephritic. Unquestionably more nephritics are to be found in the nonretention group, but the presence or absence of retention does not unequivocally label one as having a nephritic or hepatic toxemia. If this were possible, it would be very helpful in influencing the type of delivery and in advising about future pregnancies. Although interesting information has been derived from this study, no assistance has been offered in the management of these cases. Our only basis of treatment and prognosis depends entirely on the clinical condition of the patient.

#### CONCLUSIONS

1. One hundred and eighteen cases have been investigated. There were 20 cases with convulsions, 10 had retention of the dye in varying amounts and 10 had none. Three patients died in each group.
2. We have been unable to differentiate the nephritic and pre-eclamptic.
3. The majority of chronic nephritics had no retention.
4. Uncomplicated subsequent pregnancies have occurred in each group. The percentage of success was much greater in the group with retention.

5. This test has no practical value in the management of these cases. The only index of treatment is the clinical condition of the patient.

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483 BEACON STREET.

## COINCIDENCE OF FIBROID TUMOR AND EXOPHTHALMIC GOITER WITH THE REPORT OF A CASE CURED BY X-RAY CASTRATION\*

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THE interrelationship between the glands of internal secretion is a well-established fact. In a healthy state of life, when the equilibrium of these endocrines is not disturbed, we are usually unable to observe their correlation. In some of these observations, however, we recognize the manifold possibilities of influence between the ovaries and the thyroid gland. The most common phenomenon is the hyperemia of the thyroid gland during puberty, menstruation, pregnancy, and climacterium. The enlargement of the thyroid during these mark-stones of female life is still considered as being within the borderline of normality, because the thyroid enlargement subsides after the above-mentioned periods have passed.

However, we find numerous reports of persisting struma, benign or toxic, the beginning of which can be traced to some of these periods of female life: the exophthalmic goiter during pregnancy, and the juvenile struma, contracted with the beginning of the germination period.

On the other hand, the ovarian function, or rather its dysfunction, is, according to our present belief, the cause of one of the most common of uterine neoplasma, the fibromyoma. Whether or not it is a hyper- or hypofunction of the ovarian hormone is as yet a matter not fully determined. Yet, from the very fact that we never encounter

\*Case presented before the General Staff Meeting of the Hollywood Hospital, October 25, 1927, and in the Obstetrical Section of the L. A. Co. Med. Ass'n on December 13, 1927.



a fibrous tumor before puberty while an existing fibromyoma often retrogresses after the menopause, the intramural type at least, we may justly assume the cause of fibroid growth due to ovarian activity.

While thus pathologic ovarian secretion is on one side the underlying cause of fibroid growth, it is on the other side stimulating thyroid enlargement. Small wonder, therefore, that both conditions, that of fibroid tumor and of thyroid enlargement, are often encountered simultaneously. Lynch reported in a recent paper on 502 cases of fibroid tumors the presence of thyroid enlargement in 30.2 per cent. Lynch characteristically calls the goiter a fibroid of the thyroid gland. Fibromyomatous patients without visible thyrotoxic symptoms mostly acquire a heart pathology generally referred to as Fibroma-Heart. Recent examination of the metabolism test in such patients revealed an increased rate averaging between 10 and 30 plus. The so-called Fibromyomatous Heart is nothing else but a thyrotoxic heart in a light degree.

The case I am going to report developed an acute thyroid toxemia on the basis of fibroid menorrhagia.

Mrs. J. R. W. was referred for severe menorrhagia and exophthalmic goiter. Patient was thirty-nine years of age, married for seventeen years, never pregnant. Menarche at sixteen years. Menstruation was always regular but scanty. Thirteen years ago a right ovarian cyst was removed. About three years ago the menstruation started to become more and more profuse and irregular. Within the last year the bleeding lasted about two or three weeks. For three months the patient has complained of shortness of breath, is easily fatigued, sleeps poorly, has persistent headaches, occasional attacks of dizziness and fainting, poor appetite, frequently feels nauseated, and complains of poor eyesight.

Examination on February 9, 1926, revealed the following status: face and mucous membrane very pale, slight exophthalmos, pulse 160, irregular, blood pressure 130-60, temperature 98; tonsils are small and teeth good. Hemoglobin 40 per cent. Pupils equal in size, react promptly. Graefe distinctly positive, thyroid gland somewhat enlarged, size small orange, soft. All reflexes exaggerated, marked demography, trembling of the outstretched hand. Heart sounds with slight anemic murmur, lungs negative.

Gynecologic examination revealed a fibroid tumor of the uterus, rather round and not nodulated. Size of about one and one-half fists.

The metabolic test could not be taken on account of the extreme nervousness of the patient.

*Diagnosis.*—Fibromyoma uteri, menorrhagia, exophthalmic goiter.

The interesting complication in this patient is the development of an exophthalmic goiter on the basis of a menorrhagic-fibroid tumor. The severe bleeding seemed to me the main problem and the underlying cause of the patient's thyrotoxic condition. She was in no way an operative risk, either for thyroidectomy or for hysterectomy. The type of the fibroid tumor, however, seemed a good indication for roentgen radiation, and as the patient's age was near the menopause, x-ray therapy was instituted.

*Treatment.*—I subjected the patient to x-ray treatment over the ovarian region giving 34 per cent castration doses. One treatment over each ovary, abdominal and dorsal on four consecutive days. Immediately following the radiation treatment

there was a severe aggravation of the thyrotoxic as well as of the menorrhagic symptoms, necessitating a consultation with an internist. The symptoms subsided, however, gradually within two weeks. The bleeding became less profuse and stopped within about three weeks, the fibroid tumor retrogressing in size. At the same time there was a marked improvement of the patient's general condition, nervousness became less pronounced, the pulse better, and hemoglobin went up.

Ten weeks later the uterus was only little more than normal size, and metabolic test showed +11.5. The Graefe symptom was the last one to disappear totally, after about six months. A recent examination of the patient showed her to be in perfect health. The uterus is atrophic, there is a small, soft, scarcely appreciable goiter more towards the left lobe which does not give any symptoms. The patient has not been bleeding any more.

There are two similar cases reported in the literature. Khoor reported a case in 1926, in which an exophthalmic goiter disappeared after a total hysterectomy of an incarcerated fibroid tumor. Another case reported by Brown in 1924 is somewhat similar to the one I am reporting. A patient who had a benign goiter, and a menorrhagic fibroid tumor was given intrauterine mesenterium treatment. There developed suddenly acute thyrotoxic symptoms which subsided, however, in a few days. The fibroid tumor as well as the goiter shrank nearly altogether.

Groedel reported a case of struma with menorrhagia in which the goiter disappeared with the cessation of the uterine bleeding after ovarian castration. Manaberg reported in 1913 ten cases of basedow which reacted favorably to radiation of the ovaries. In most cases of exophthalmic goiter the ovarian radiation is *not* indicated because the vast majority of cases show rather amenorrhic symptoms, not menorrhagia. Those patients with little or no uterine bleeding are even regarded as a contraindication to radiation.

Deutsch reported several cases in which slightly bleeding patients with fibromyomas who were subjected to x-ray treatments developed signs of myxedema in three cases. Groedel drew from these cases the conclusion: Ovarian castration may cause a hypofunction of the normally acting thyroid gland, but in exophthalmic goiter it may reduce the thyroid hyperfunction to normality, thus restituting the equilibrium of the endocrine glands.

While I do not wish to draw any definite conclusion from the single instance reported, the literature contains a number of cases with similar complications in which castration was of great benefit. Proper selection of cases, especially in regard to the age of the patient to be castrated and proper indication for x-ray therapy, are a "*conditio sine qua non*." In our case the x-ray castration was without doubt a life saving procedure.

# Society Transactions

## NEW YORK OBSTETRICAL SOCIETY\*

MEETING OF MARCH 13, 1928

### DR. BYRON H. GOFF described **A Case of Secondary Abdominal Pregnancy.**

A Spanish woman of thirty-eight was admitted to the Woman's Hospital, July 7, 1927, complaining of constant, moderately severe, pelvic and lower abdominal pain, principally dull in character but at times sharp, and of 3 months' duration, amenorrhea of 16 weeks' duration followed by metrorrhagia of moderate degree which appeared two weeks before admission to the hospital, and an enlargement of the lower portion of the abdomen. Menstruation normal. The last regular period began on February 28, 1927, approximately 18 weeks before admission to the hospital.

The patient had been married for eight years, and had borne two full-term children, one seven and the other six years ago. The first pregnancy was complicated by lobar pneumonia at the seventh month. The second pregnancy was normal. Labors were spontaneous and the puerperia uneventful. There was no history of abortion.

With the exception of the attack of pneumonia which complicated the first pregnancy, the patient had had no other illness. There had been no history of pelvic inflammatory disease. Both husband and wife denied having had venereal disease.

The last menstruation occurred approximately eighteen weeks before admission to the hospital. Two weeks before admission there had been a moderate amount of uterine bleeding each day, usually in the form of clots. During the last three months of the period of amenorrhea the patient had suffered from a constant dull pain in the lower abdomen and pelvis, especially in the left side. At times the pain became sharp and radiated toward the rectum. There was, however, no one attack more severe than the others. For several weeks there had been colostrum in the breasts and a noticeable enlargement in the lower portion of the abdomen. The general health of the patient had been only slightly impaired.

Physical examination negative. The breasts were well developed and contained a large amount of colostrum. The abdominal muscles were relaxed over the upper one-half of the wall but slightly rigid below the umbilicus, with marked tenderness, especially over a semisolid, irregularly-shaped mass which filled the greater portion of the lower abdomen and extended to the level of the umbilicus. Nothing abnormal could be discovered in the upper abdomen. There was no sign of hernia.

The pelvic floor was intact and its function normal. The vaginal walls were intact. The cervix which was normal in appearance was displaced downward, for-

\*The clinical case reports at this meeting were contributed by members of the attending staff of the Woman's Hospital.

ward and to the right by the pelvic mass. Its canal was slightly more patent than normal and the internal os was open. A moderate amount of blood from the uterine body came through the canal.

The uterus, which was very slightly enlarged, was displaced to the right, upward and forward by the pelvic mass, and fixed. The uterine appendages could not be palpated because of the semisolid tender mass which almost filled the remainder of the pelvic cavity, and was continuous with the mass which could be palpated through the abdominal wall.

A diagnosis of ectopic gestation was made and operation decided upon. Drs. Bissell and Rawls, who saw the case in consultation agreed with the diagnosis.

The abdomen was opened by a midline incision extending from symphysis to umbilicus. The pelvis and lower abdomen were filled by a semisolid asymmetrical, immobile mass, obscured from view by the adherent omentum. Upon separating the omentum the slightly enlarged uterus was found fixed in the right side of the pelvis by the mass. Several loops of ilium, the rectum, and sigmoid, were attached to the mass by recently formed adhesions. Both tubes entered and were incorporated in the mass, as was the left ovary. The right ovary was adherent to the broad ligament but was otherwise normal. In the right iliac fossa there was an embryo 8.5 cm. in length attached to a small umbilical cord which disappeared in the pelvic mass. To the dorsal region of the embryo a loop of ilium was adherent. There was no sign of the fetal sac. Following the removal of the embryo an effort was made to separate the adhesions between the mass and intestines but was abandoned because of the profuse bleeding and the inevitable damage to the bowel which would have resulted. Because of the rather free oozing from the peritoneal surface from which the embryo was separated, and from the peritoneum in the left iliac region to which the omentum had been attached, a cigarette drain was placed in each iliac fossa and carried through the lower angle of the abdominal incision. It is to be noted that no drain was placed in the true pelvis. Because of the density of the adhesions and the impossibility of separating them, the attachment of the embryo could not be determined. The abdomen was closed in layers by nonabsorbable material.

The recovery was uneventful. The highest postoperative temperature was 102° on the first day and was normal by the fourth day. The highest pulse rate was 112 on the first day and normal on the fourth day. Respiratory rate, 24 on the first day and normal on the fourth day. The drains were slowly removed, and the wound healed by primary union excepting at the drainage site. The patient was discharged 35 days after admission, having been detained until the abdominal incision was completely healed. The pelvic mass was markedly reduced in size. Symptoms, with the exception of slight, occasional pelvic pain, had disappeared.

Since July 30, 1927, the day of discharge from the hospital, the patient has been examined twice. Symptoms, with the exception of occasional dull pain in the left lower quadrant of the abdomen, have disappeared. Menstruation is normal. The general health of the patient is good. The uterus is now slightly enlarged, but otherwise normal. The pelvic mass has gradually diminished in size so that at the present time it consists of a slight thickening of the left appendages. Nothing abnormal can be palpated in the right side of the pelvis or culdesac. In all probability operation will not be necessary.

*Comment.*—Unfortunately this case of abdominal pregnancy cannot be accurately classified as to type because of the impossibility of locating the placental attachment at the time of operation. It had its beginning, in all probability, in the left uterine tube and later became abdominal. Because of the absence of a history of any intrapelvic catastrophe early in the pregnancy, one is inclined to believe that the ovum may have been aborted by the tube rather than to have reached the ab-

domen through a rupture of the tube wall. The size of the fetus seems to indicate that in all probability it survived until the end of the fourth month of gestation.

### DR. A. H. ALDRIDGE described an instance of **Menstruation into the Bladder from a Vesicovaginal Fistula Due to Childbirth Injury.**

M. W., a poorly nourished negress, single, twenty-nine years of age, was admitted to the Woman's Hospital on July 22, 1926, complaining of incontinence of urine since her labor at nineteen years of age. She denied having had any previous serious illness or operation. Her menstrual periods were always regular and normal until the time of her confinement. After the delivery the periods were still regular but she stated that when she menstruated the urine was stained with blood for the usual period of three days and then that she continued to pass white flaky material in the urine for a few more days. She had a menstrual period twelve days before admission to the hospital.

Although she weighed only ninety-seven pounds and appeared to be poorly nourished, her general physical examination was essentially negative. Examinations of the blood and urine were normal. The blood Wassermann was negative.

When her labor began, a midwife who was called to attend her stayed only a short time and advised that she be called later when the pains were more severe. She did not call the midwife again for sixty-eight hours after the time when she thought that the labor began. In the meantime she was not comfortable but had been up and about. She stated that she had practically no pain and called the midwife at the time of delivery because the baby's head appeared. The baby was spontaneously stillborn soon after the midwife arrived. No instruments were used for the delivery. She had no anesthesia during her confinement and seemed to be very positive about the details regarding it. She claimed that she had only slight discomfort during the labor and delivery. She did not know the weight of the baby but thought it was about the usual size for a newborn baby.

In view of the history her pelvic measurements are interesting, and as follows: between the spines, 26 cm.; between the crests, 29 cm.; right oblique, 21.5 cm.; left oblique, 21.5 cm.; external conjugate, 15 cm.; depth of symphysis, 6 cm.; transverse diameter of outlet, 7.5 cm.

She claimed that she had lost urine from the time that the delivery was completed until admission to the hospital ten years later. The convalescence was otherwise apparently normal with nothing in the history pointing to a postpartum infection. She was up and about ten days after delivery.

For nine years after delivery she was able to retain a small amount of urine and to void occasionally in the normal way. However, for one year prior to admission she had had total urinary incontinence.

She was kept under observation in the hospital for several days before any operative work was attempted.

Bimanual examination revealed a small retroverted uterus which was somewhat movable but could not be replaced. The tubes and ovaries seemed to be normal to palpation. Inspection of the vagina showed an irregular linear scar running diagonally across the vault toward the left side of the anterior wall. At the anterior left end of this scar there was an elliptical-shaped opening about one-half centimeter in length from which urine was constantly escaping into the vagina. This opening was on the anterior wall about two centimeters from the apex of the vault and one centimeter to the left of the midline. There was considerable fixa-

tion of tissues in the vault of the vagina about the sear described above. In the center of the sear there was a small dimple which was at first thought to be the external os of the cervical canal. Numerous attempts to pass a small probe through the opening were unsuccessful.

It was then decided to examine the bladder through the cystoscope to determine to what extent the injury had involved the base of the bladder and to decide whether there would be danger of injury to the ureteral orifices in closing the vesicovaginal fistula. On account of the fistula it was difficult sufficiently to distend the bladder in order to get a satisfactory inspection of its interior. The patient was so extremely nervous and sensitive that the examination was finally carried out under parasacral anesthesia. It showed clearly the ureteral orifices which were normal in position and uninvolved by the injury. It also showed the vesicovaginal fistula and in the center of the triangular area between the ureteral orifices and the fistula another depression was noted, believed at first to be a diverticulum of the bladder. We were surprised to find that a ureteral catheter could easily be passed into this depression for a distance of six centimeters.

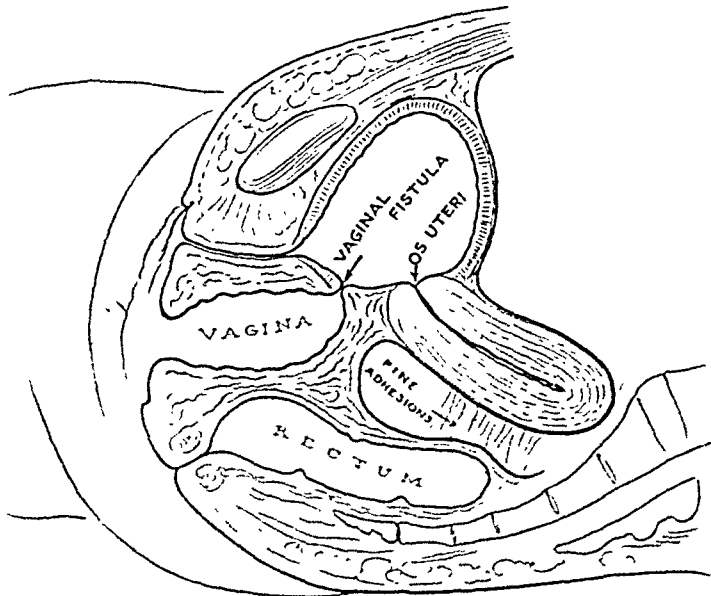


Fig. 1.—Showing relation of cervix to bladder.

We then believed that this was the external os of the cervical canal. In other words it seemed certain that there had been a childbirth injury which had left an opening through the vault of the vagina into the bladder and that as the uterus had involuted following delivery it had retroverted thereby rotating the cervix through the opening into the bladder. The injured area had then healed sufficiently to enclose the external os of the cervix in the bladder. Furthermore the healing of the injury was not quite complete so that a vesicovaginal fistula resulted at its anterior end.

To prove this theory operation was delayed until the patient menstruated, when she was again cystoscoped. Bloody fluid was then seen escaping from the depression in the base of the bladder. (Fig. 1.)

The surgical problem which presented itself was therefore twofold: First, to stop the menstruation in the bladder; and second, to close the vesicovaginal fistula.

There was much dense sear in the vault of the vagina about the cervix and the external os of the cervical canal had been found very near the ureteral orifices.

It was believed that an attempt to dissect the cervix away from the base of the bladder might result in an injury to the base of the bladder or ureters which would be very difficult to repair. It was therefore decided to do a supravaginal hysterectomy first, removing as much of the cervix as possible and later to close the vesicovaginal fistula.

It was considered unwise to close the vesicovaginal fistula first as it was feared that an infection of the uterus and pelvic structures might result from inadequate bladder drainage. The condition had been long standing and the bladder tone was sure to be poor. It was believed that under the circumstances any stagnation in the bladder would predispose to infection of the pelvic organs.

This procedure was followed. At operation the uterus was found retroverted and adherent to the peritoneum of the pelvis. The left ovary was cystic. A supravaginal hysterectomy was done and the left ovary was resected. Fourteen days later the vesicovaginal fistula was closed by the Sims method using interrupted silver wire sutures which were left in for fourteen days. A Sims block tin retention catheter was left in the urethra for seventeen days. The patient was discharged from the hospital twenty-one days after the second operation.

She was seen and examined at two months and again at six months after she left the hospital. The condition was satisfactory both anatomically and functionally.

### Dr. H. R. MIXSELL described an instance of **Congenital Atresia of the Esophagus with Tracheal-Esophageal Fistula.**

A baby born, November 30, 1927, after a low forceps delivery, at term. Birth weight, 6.5. The child was apparently normal, the only symptom noted was anorexia and persistent meconium stools. On December 5, the baby vomited immediately after every feeding, the vomiting being nonprojectile in character. Examination on that day showed a markedly dehydrated infant weighing 5.4 (a loss of 17 ounces in five days). No reverse peristalsis seen. A congenital anomaly, either stricture of esophagus or atresia of duodenum, was assumed to be present. The roentgen examination showed a complete atresia of the esophagus.

Death followed on December 7 on the eighth day. The autopsy showed a normal baby except for the following: 5 cm. from the epiglottis the esophagus ended blindly and deviates slightly towards the right. The diameter of the upper portion of the esophagus is 1 cm. Cardia normal. A probe inserted into the lower end of the esophagus passes upwards without resistance until the point hits the base of the skull. The upper end of the probe passes through the larynx. The lower end of the esophagus is dilated (on account of barium x-ray). Corresponding to the lower end of the blind upper portion of this esophagus an ovoid fistula (1 cm. long) is seen in the posterior wall of the trachea, its lower edge being 4 mm. above the blind end of the upper part; the edges are sharp and the opening seems to be situated only in the membranous part. The axis of the esophagus and that of the trachea are nearly mathematically the same. The lower half of the fistula corresponds to the bifurcation and is 7 cm. above the cardia (Fig. 1).

A very careful search of the entire body with exception of the skull did not reveal any other anomaly. This is the more astonishing since the malformation in question must have been there at a stage when the whole fetus was not longer than 4 or 5 mm.

Dr. Mixsell had only seen one other case like it in four years experience at the Woman's Hospital and that child also lived about eight days.

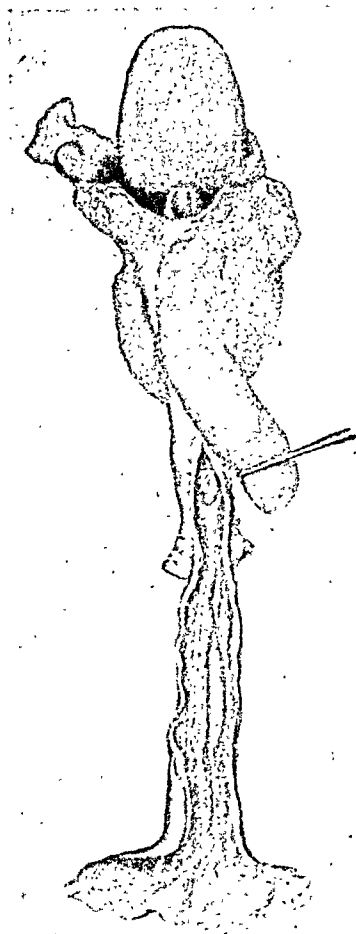


Fig. 1.—Esophago-tracheal fistula.

**DR. RALPH L. BARRETT** reported a case of **Intrapartum Hemorrhage from a Ruptured Varicosity in the Vault of the Vagina.**

The alarming character of the hemorrhage together with the difficulty of differential diagnosis and the rarity of case reports of this condition warrant the presentation.

Mrs. B. E., aged thirty-five, married six years. She had had one previous pregnancy, one year ago, which resulted in a spontaneous abortion at the eighth week. There were no complications at that time and no curettage was done. The patient was a well nourished, athletic type of woman, 5 feet, 8 inches in height, weighing 145 pounds at the beginning of her pregnancy, and 175 pounds at term. Physical examination was normal, and the pelvic measurements were adequate. There were no external varicosities. During her pregnancy she had been under the usual antepartum observation. Her blood pressure and urinary findings were normal throughout pregnancy until the thirty-eighth week. Her pregnancy was uneventful until the beginning of the thirty-ninth week, when for the first time she showed some edema of the feet with a faint trace of albumin in the urine, also a rise of blood pressure to 130/74. She was placed on a diet of carbohydrates and green vegetables, with a limited amount of milk and no added salt. She was also given one ounce of Epsom Salts each morning and put to bed.

Three days later, August 22, 1926, her blood pressure was 152/90 and the urine showed a heavy trace of albumin, and for the first time, the urine sediment showed



an occasional hyaline cast. Her complexion was pasty in appearance and she complained of mild headaches. There was some edema of the face and hands. She was admitted to the Woman's Hospital on this date.

In the hospital she was put at absolute rest in bed and was given high colonic irrigations of soda bicarbonate twice in twenty-four hours. Her diet was limited to milk and water. On the next day, August 23, 1926, she complained of severe headache and epigastric pain. The edema of the feet was less, but it was more marked in the face. The blood pressure was 170/110, the urine boiled solid and contained 20 grams of albumin per liter. She had no visual disturbances and the eye-grounds appeared normal. It was evident that toxemia was advancing rapidly in spite of dietary and eliminative treatment. The patient seemed to be nearing the eclamptic state.

At 6 P.M., August 23, 1926, under light gas and ether anesthesia an extraovular insertion of a No. 4 Voorhees bag was made in the lower uterine segment. The

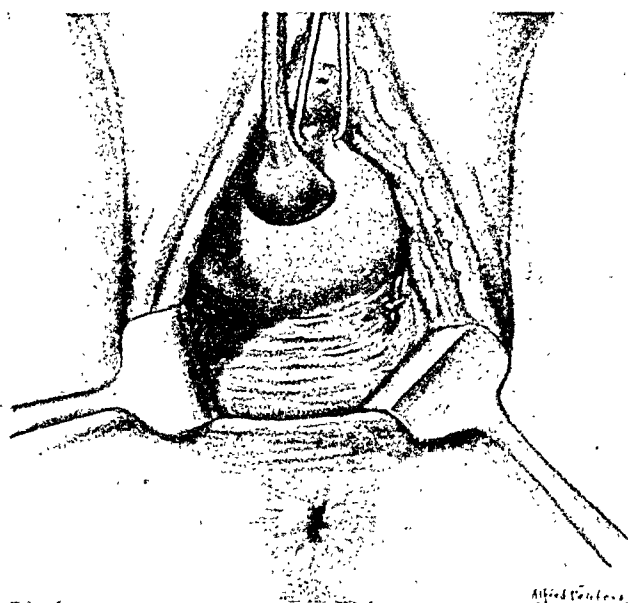


Fig. 1.—Showing site of ruptured varicose vein in vaginal vault.

membranes were not ruptured. At this time the cervix was soft, about 3 cm. dilated. The baby was presenting by the vertex, in the R. O. A. position, there was no engagement. The fetal heart was 148. Uterine contractions began about one hour later and by 8:30 they were regular, at five minute intervals, and labor seemed to be progressing satisfactorily. About three hours after the insertion of the Voorhees bag there was sudden, fairly free, bright colored vaginal bleeding; this continued without apparent change. The uterine contractions continued at three to five minute intervals and seemed normal in character. There was no change in the fetal heart rate.

The source of the bleeding was unknown. Placenta previa was considered, also bleeding from premature separation of the placenta or from laceration of the cervix due to its dilatation by the bag. By 10:30 P.M. the bleeding seemed to be increasing and there had been an estimated loss of 600 c.c. of blood. At this time the maternal pulse had increased from 72 to 98, and the blood pressure was 160/90. The patient was taken to the delivery room, and a careful exploration made under gas and ether

anesthesia. There was a constant trickle of fresh blood from the vagina. The Voorhees bag was found to be in place in the lower uterine segments, and the cervix now dilated about 5 cm.

About one-third of the bag was protruding through the cervix. The bag was removed but no blood was found in the lower uterine segment and there were no clots. The membranes were intact and no placenta could be palpated. The vertex was presenting in the R. O. A. position at the brim. Further search revealed a large, dilated varicose vein high up on the posterior vaginal wall just to the left and posterior to the cervix. This vein was ruptured and was the source of the free bleeding. Attempts to suture the vein were unsuccessful and after replacing the Voorhees bag in the lower uterine segment the whole vagina was tightly packed with two-inch iodoform gauze. The bleeding was controlled in this manner and labor continued through the night. At 6:30 the next morning there was some protrusion of the gauze from the vagina and again fresh vaginal bleeding. The vaginal packing was removed and the vagina again repacked with iodoform gauze. This controlled the bleeding. The blood pressure at this time was 160/90 and the maternal pulse 110; fetal heart 152.

About 2 P.M., August 24, there was a rather free discharge of watery, blood-tinged fluid, apparently from rupture of the membranes. One hour later the vaginal packing and bag were partially expelled and were removed from the vagina. There was no further bleeding at this time. Strong uterine contractions continued at two to three minute intervals for the next two hours, with failure of labor to progress beyond 8 cm. dilatation of the cervix. The vertex was still at the brim in the R. O. A. position. The mother was becoming exhausted, her temperature was now 100° and her pulse 112. The fetal heart was irregular and there was a discharge of meconium from the vagina.

Under gas and ether anesthesia the remaining rim of cervix was dilated manually and a rather difficult internal podalic version and a breech extraction were done, with the delivery of a living female child weighing 8 pounds, 9 ounces. Immediately following delivery there was considerable fresh bleeding. Manual extraction of the placenta was done at once and a tight tamponade of the uterus and vagina was made with two-inch iodoform gauze. A moderate second degree laceration was repaired with chromic catgut. Two hours after delivery the maternal pulse rate was 118 and the blood pressure was 160/100. There was no further bleeding. The blood count two days later showed a hemoglobin of 50 per cent, red blood cells 2,324,000, white blood cells 22,600, polys 82 per cent, lymphs 18 per cent. The antepartum blood count on the day of admission to the hospital showed hemoglobin of 73 per cent, red blood cells 4,080,000, white blood cells of 8,800. The uterine and vaginal packing was removed on the third day and there was no further bleeding during her puerperium.

The mother and baby made an uneventful recovery. They were discharged from the hospital on the twenty-sixth day. At that time the mother's blood pressure was 125/75, the urinary output was normal and contained only a very faint trace of albumin, too small for quantitative determination. Phenolsulphonephthalein test showed 55 per cent elimination in two hours. Her blood count showed a hemoglobin of 60 per cent, red blood cells 3,280,000, white blood cells 10,000. At the end of three months the urine was entirely normal, her blood pressure was 120/65, she had a hemoglobin of 80 per cent and the red blood cells were 4,200,000.

A search of the literature in reference to this complication has revealed only three reported cases of hemorrhage from ruptured varicose veins of the vagina.

Aitken in the *British Medical Journal* for 1922, reports a case of rupture of varicose veins high on the anterior vaginal wall. This occurred two days before

the onset of labor and caused an infiltration of the vaginal wall with severe hemorrhage, controlled only by vaginal packing with pressure against the pubic bone.

Kaufman in *Döderlein's Handbuch der Geburtshülfe*, 1925, reports a case of hematoma of the vagina originated from ruptured varicosities.

Cecil, in *Louisville Medical Monthly*, 1895-96, describes a case of ruptured varicose veins high in the vagina, at the onset of labor and the bleeding simulated placenta previa or accidental hemorrhage.

In the case reported there was difficulty of exact diagnosis until careful search had been made under anesthesia, and the ruptured vessels had been visualized. The bleeding was similar to that which occurs from lacerations of the cervix incident to dilatation. The differential diagnosis from placenta previa or from premature separation of the placenta was definitely made only after careful examination and inspection under anesthesia. The important feature of the case is the fact that dangerous hemorrhage may occur during labor from rupture of varicose veins in the upper vagina. The increased pelvic congestion and stretching incident to pregnancy and labor is probably the etiologic factor in the rupture of the distended veins, which in this case were superficial and thin-walled. DeLee believes that there are degenerative changes in the vessel wall due to a toxemia of pregnancy.

#### DR. EDWARD C. LYON, JR., reported a case of **Fatal Postpartum Hemorrhage from a Ruptured Varicosity in the Culdesac of Douglas.**

Mrs. B., twenty-five years of age, a primigravida, was admitted to the Prenatal Clinic, March 25, 1927, at about the fifth month of pregnancy (expected labor August 9, 1927). The routine examination, at this time, showed measurements within normal limits, the fundus 2 cm. above umbilicus, and the fetal heart not heard. The right appendage was enlarged and tender, the blood pressure and urine were normal and the Wassermann was negative. This patient made ten subsequent visits to the Prenatal Clinic, during which time the blood pressure and urine remained normal and her general condition good.

She was admitted at 10:35 A.M., July 25, 1927, two hours after the onset of labor. The first stage was normal, lasting four hours and thirty minutes, during which time the contractions were strong and effectual. The second stage was one hour and fifty minutes, with strong frequent contractions, and it terminated in a spontaneous delivery without complication or laceration. The baby was in good condition, weighed six pounds and nine ounces and measured 48 cm. long. The third stage was six minutes. The placenta was intact and expelled spontaneously with the membranes complete. The uterus contracted well, without undue bleeding and no unusual handling of the fundus occurred. One c.c. of a standard pituitary extract was given hypodermically immediately after the birth of the baby and one c.c. of an ergot preparation, also by hypodermic, after the delivery of the placenta. The patient was sent to the ward in good condition.

The delivery of this patient was at 2:20 P.M., July 25, and at 4 P.M. her temperature was 100.4°, pulse 76 and respirations 20. She was seen by the resident obstetrician at 7 P.M. and found to be in good condition. At midnight her temperature was 100.2°, pulse 80, and respirations 20. Then at 3:15 A.M., the nurse heard the patient groaning as if in pain. Her pulse was weak, extremities cold and she complained of some pain in the chest and slight pain in the lower abdomen. She was seen immediately by one of the intern staff and found to be in marked shock, with no external bleeding. Routine measures for shock were instituted, and the Resident, who came up at once, found her in a critical condition which became rapidly worse. The patient died in shock at 4:35 A.M. one and one quarter hours after the nurse

noticed a change in her condition. Those who saw this patient were at a loss to say what was the cause of the shock and as a result this became a coroner's case. The autopsy was performed by Dr. Gonzales and the findings follow:

*Uterus.*—Large; walls very thick; with a large subserous fibroid about the size of an orange, pedunculated, at the fundus. There are a number of intramural fibroids also. Internal ring natural; there is some clotted blood attached to the uterine mucous membrane. In the culdesac on the left side is a small rip in the peritoneum showing a dilated vein which had ruptured. Ovaries: Right ovary shows a corpus luteum with the usual luteum cells; tubes and the other ovary natural.

*Anatomical Diagnosis.*—Hemorrhage into abdominal cavity from ruptured dilated vein of the pelvis. Uterine fibroid both subserous and intramuseular. Edema of organs. Acute vegetative mitral valvulitis. Cause of Death: Hemorrhage into abdominal cavity following rupture of a varicose vein in the culdesac of Douglas during delivery, full term, natural; contributory: uterine fibroid.

In discussing such a case, several questions at once arise, chief of which are: when did this rupture occur? And how could it have been avoided? It is most natural to assume that this vein ruptured during the labor or delivery. Yet if it did occur then, is it probable that bleeding would continue for so long a period of time, twelve hours, and the patient retain a normal pulse and show no symptoms? If the rupture occurred at the time the patient complained of pain, such an explanation would fit in with the sudden onset of shock but would be hard to understand with no manipulation or possible trauma occurring at this time. Undoubtedly many explanations might be offered, though with the data at hand they must be only conjecture. As for preventing such an accident, really nothing can be done, because of the impossibility of diagnosing thin walled varicosities or determining whether they are situated at points of special stress or strain. The fibroids were not recognized antepartum or postpartum, but even assuming they were responsible in part for the varicosity, one cannot say that a knowledge of their presence would have altered the handling of the case or caused one to apprehend the rupture of a pelvic vein. Naturally one always thinks of hemorrhage in cases of sudden shock, and one always should, yet here, with no external bleeding, a contracted uterus, and a persistently slow pulse, the possibility of an intraabdominal hemorrhage did not seem important. Fortunately, such an accident as occurred in this case is extremely rare. Doederlein in his *Handbuch d. Geburtshilfe* quotes six cases, which he collected from the literature, of death from rupture of varicosities within the abdomen during pregnancy or delivery. A review of the American and English textbooks on Obstetrics adds no more cases, though DeLee and E. P. Davis mention such a possibility.

#### DISCUSSION

DR. A. B. DAVIS wanted to emphasize the fact that in every case he had seen there has been acute abdominal tenderness.

DR. DOUGAL BISSELL said that the case reported by Dr. Aldridge is one not commonly met with today but was not uncommonly encountered in the days of Sims and Emmet. Today we find retroversion following labor in about twenty per cent of cases. In the day of Sims it was much greater because of poor obstetrics. Under these circumstances it would seem extensive injury to the anterior vaginal wall was not at all infrequent. With such an injury, or one as large as the cervix itself, it is perfectly logical when a uterus assumes, in its process of involution, a retroverted position, that the cervix should move anteriorly, pass

through the opening into the bladder and be caught and anchored there in the healing process of the injured vaginal and bladder walls.

DR. W. P. HEALY commented on Dr. Aldridge's statement to the effect that supravaginal hysterectomy was deemed desirable because of the risks of infection into the uterus and tubes if the uterus were left in place, and the menstrual flow had to go through the bladder. Dr. Healy observed such a case, in which there had been a congenital absence of a portion of the vagina, and when the young woman reached the age of puberty and the menstrual cycle established itself and did not appear externally, a surgeon did an abdominal operation, and whether intentionally or accidentally he connected up the cervix with the bladder. The patient did not come under Dr. Healy's observation until after she had married and had conceived as a result of intercourse through the urethra and she had a dead fetus in the uterus. Her surgeon then in charge thought she had an ectopic pregnancy and did an abdominal operation and removed the fetus from the uterus. The anatomic arrangement in the pelvis was evidently very confusing to him. He was satisfied to get rid of the fetus and the placenta and did not do a hysterectomy. She came under observation after that operation. At this time she was suffering a good deal from vesical incontinence as the result of all the examinations that had been made through the urethra, and she had, of course, a very marked cystitis. After a conference with her and her husband it was agreed that they did not want the uterus removed. Dr. Healy advised supravaginal hysterectomy, as the method of terminating the menstrual flow through the bladder, but that was declined. They wanted to have the incontinence treated, which was a difficult problem unless the husband would agree that he would not interfere later with any operative procedure which was carried out. Dr. Healy then operated for the incontinence, resecting a large portion of the posterior urethral wall from the orifice up to the bladder and reconstructing a little more vaginal canal. It is interesting to note that the operative result on the incontinence has been satisfactory. At present this patient is menstruating through her bladder and has urinary control.

#### DR. GEO. W. KOSMAK reported a case of **Fetal Death Due to Intra-uterine Rupture of a Velamentous Cord.**

It was the second one in his experience. The patient, aged thirty-five, had been married seven years, with one induced miscarriage five years ago. Her menstrual history was regular, the periods being profuse and marked by cramps for two days. Her last period began December 10, 1926, and the end of her pregnancy was expected about September 16, 1927. She had marked nausea and vomiting in the early months and was very constipated. She believed that she felt life about April 14.

She gave a history of having had an attack of Dengue fever three years ago and had resided in Cuba for the last four years, and before that in the Argentine. There was no malarial history. Patient was a slight, moderately well nourished woman, weighing 109 pounds, with a low blood pressure and aside from a slight puffiness of both ankles presented nothing abnormal throughout her pregnancy.

After a strenuous day of shopping, etc., on September 8, she developed irregular abdominal pains and a sudden rupture of watery bright red fluid on the following morning. Examination about two hours later after admission to the Woman's Hospital showed the head well engaged; cervix thin, two fingers dilated with a slight bloody discharge present. A considerable number of firm clots had been previously passed. There were no fetal movements or heart sounds and the patient stated that she had not felt the baby during the previous day. General condition good, pulse

about 90, respirations normal, color as usual. A tentative diagnosis of premature separation of the placenta was made although there were none of the accepted signs present, such as pain, uterine rigidity or tenderness, board-like abdomen or

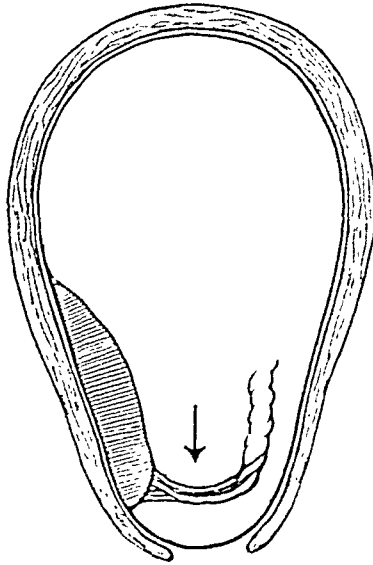


Fig. 1.—Diagram showing situation of placenta and velamentous cord.

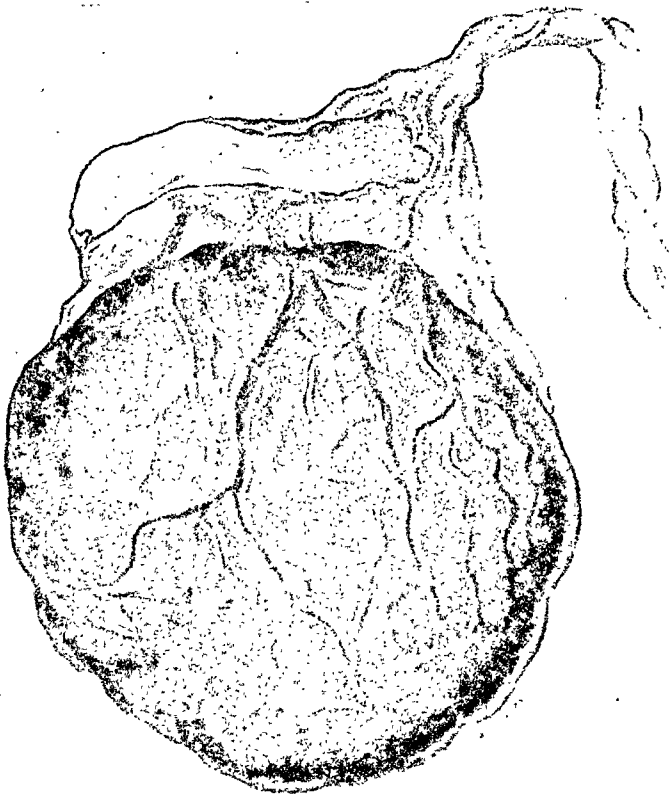


Fig. 2.—Showing laceration in a velamentous cord attachment.

constitutional evidences of hemorrhage. Dr. Kosmak considered the possibility of a ruptured velamentous cord from his previous experience but in view of the patient's general good condition no interference was attempted as the baby was believed to be dead. Strong regular pains continued throughout the day and after the head

reached the level of the spines no further progress resulted. An easy forceps extraction was done under gas-oxygen-ether anesthesia and a well nourished dead baby, weighing 6 pounds was extracted, which showed no evidences of life. A moderate amount of dark blood followed the delivery of the child and the placenta was expressed without difficulty about a half-hour later by slight Credé. Examination of the secundines disclosed the condition shown in Fig. 1. The attachment of the placenta was evidently low down in the uterus as the rupture of the membranes occurred near the edge (Fig. 2). The maternal surface of the placenta was normal, there were no retroplacental clots and only a slight degree of fibroid and fatty degeneration, with no evidences of infarcts. The patient bled only about 30 c.c. and was returned to bed in good condition and made an uninterrupted recovery.

A previous instance of this unfortunate complication of labor was reported by Dr. Kosmak in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY (Vol IV, p. 19). In the latter case a diagnosis of premature separation of the placenta associated with a uterine fibroid indicated a cesarean section, during which the true condition was discovered.

DR. J. R. GOODALL, of Montreal, presented a paper (by invitation) entitled **Cervical Infections in the Puerperium**. (For original article see page 339.)

#### DISCUSSION

DR. BYRON GOFF said he was disappointed at the doctor's failure to touch upon an extremely important phase of the subject, namely, immediate repair of the lacerated cervix as a possible means of preventing cervical infections in the puerperium. It is a generally accepted fact that the lacerated cervix is more likely to become infected during the puerperium than the cervix which has escaped injury. It would seem logical, therefore, to repair the lacerated cervix at the termination of the third stage of labor, and, thereby, prevent many such infections.

About three years ago Dr. Goff became interested in immediate cervical repair, largely through reading of the work of Dr. E. P. Davis, Dr. DeLee, and Dr. Ludwig Emge, and began routine examination of the cervix immediately after the third stage of labor in primiparae with the idea of repairing significant injuries. His first efforts were directed toward learning the appearance of the normal and the lacerated cervix. For a period of six months he examined the cervix of each primipara and made notes on the condition found. The notes were checked against the findings at the end of the second week and the second month postpartum. When satisfied that he could detect a cervical injury with certainty, he made an attempt at primary repair.

During the past two and a half years Dr. Goff examined in private practice the cervixes of approximately 200 primiparae at the termination of the third stage of labor and learned the following facts: (1) The individual who does not make a practice of examining the cervix routinely at the end of the third stage of labor is unable to differentiate between the normal and the lacerated cervix. (2) Approximately 40 per cent of cervixes in primiparae have significant injuries. (3) Immediate repair of the cervix is feasible. It is, however, not an easy operation. (4) The operation should not be attempted by anyone who cannot perform the usual plastic operations on the cervix and vaginal walls. (5) The procedure should be attempted only in a well equipped operating room where at least one good assistant and an anesthetist are available. (6) The method of repair is important. The type of suture used in the usual trachelorrhaphy gave poor results. The mattress suture as suggested by Emge gave very satisfactory results. (7) Faulty

union will occur in a very small percentage of cervices which have been properly repaired. (8) The end results which follow immediate repair of the cervix are very encouraging. Cervices which have healed well are normal in size and in a very small percentage of cases is infection present. (9) When the standard of The American College of Surgeons is applied, the puerperal morbidity in cases subjected to immediate repair of the cervix should not be any higher than in cases in which vaginal injuries have been repaired.

DR. WILBUR WARD said that out of the mass of facts Dr. Goodall has given there are two or three things which stand out.

The first is about the cervix at the termination of the third stage. The cervix at the end of the third stage of labor is edematous, it is everted, it is eroded, it is lacerated in 100 per cent of cases, and this is to be expected, considering what has happened in the previous few hours.

This leads to the next thing, namely, the question of infection of that eroded, lacerated, edematous, hypertrophic tissue with the organisms which are always intrinsically present. In other words, it is always infected, and we naturally expect a certain number of reactions from the infection of that cervix.

The third thing is the question of morbidity. A pregnant woman who goes through an ordeal, serious in a great many cases, in any case a physical strain, with contusion, laceration, hemorrhage must show some normal reaction. Therefore he did not agree at all with Dr. Goodall's morbidity range. No surgeon expects to take out an interval appendix under the most favorable circumstances and not have a reaction from absorption of catgut, of blood-clots, dead cells, etc. It is a normal, natural thing. Why should we expect to take a surgical proposition, which labor is, and not have a reasonable reaction without calling it a morbidity? In other words, he believed Dr. Goodall had taken too high a standard for his range of morbidity.

DR. G. W. KOSMAK felt that this is assuming greater importance every day in our obstetric treatment.

There is one phase that he would like to comment on particularly; namely, the treatment of the infected cervix during pregnancy. Dr. Ward has just said that that is still undecided. Dr. Kosmak had not decided it in his own mind, but nevertheless he was trying out in private cases the results of active treatment of the infected cervix during pregnancy. He said that he believed it to be the duty of the obstetrician to pay more attention to the cervix during pregnancy than he has in the past. In the antepartum examinations of the patient we should pay closer attention to her statement about vaginal discharges and in every case we should make a routine examination of the cervix with the aid of the speculum, not only in multiparae, but also in primiparae. He was rather astounded in examining young women at the fifth and sixth month of pregnancy, who complain of annoying discharges, to find the cervix very much congested, frequently hypertrophied to two and three times normal size, with rather extensive areas of erosion that bleed as soon as they are touched with the sponge. Again in cases earlier in pregnancy that complained of bleeding, showed that this bleeding did not proceed from the uterus, that it was not an evidence of an impending miscarriage, but that it came from an eroded and extensively ulcerated cervix.

The question is what to do with these cases. Does the presence of an infected cervix of this kind during pregnancy, even in multiparae, contribute something to the marked endocervicitis which we see so often during our examinations after labor? Dr. Kosmak believed it does, although not prepared to qualify that statement by actual statistics as yet. Those patients in whom he succeeded in keeping the condition more or less in check, even if he could not cure it, seemed to go



through a fairly normal puerperium without any elevation of temperature, and in whom after delivery the cervix was found not in as bad a condition as in a great many multiparous patients who came with cervices that were already lacerated and diseased. Dr. Kosmak believed that these infections went back to early childhood. We find a great many little girls who develop vulvitis, subsequently a vaginitis, and in whom the process is a long drawn out one that is very resistant to treatment. Possibly this infection extends inward and reaches the cervix, to be lighted up, even years later when the girl is married and becomes pregnant.

Again, I believe that many men have been negligent in their postpartum examinations, and I have been rather astounded in questioning patients that in many instances where I have found markedly infected and diseased cervices that patients have been discharged by their obstetrician without a satisfactory examination of the cervix with the speculum. Now, the ordinary bimanual examination tells us nothing. We feel possibly a lacerated cervix, but we pay very little more attention to it, and, in fact, we cannot understand the true condition present unless we actually insert a speculum and get a look at the cervix.

I think Dr. Goodall has very wisely drawn our attention again as many others have done, to the importance of the cervix in pregnancy and in the puerperium, and I believe that this lesson should be engrafted to such an extent that every one of us will go away from here with the intention to inspect the cervix during pregnancy and after pregnancy more often than we have in the past.

DR. H. B. MATTHEWS said he wanted to call attention to the marked reduction in morbidity by the proper use of 4 per cent mereurochrome at the Methodist Episcopal Hospital, as a vaginal and cervical germicide. Furthermore if a comparison is made of the morbidity from the standpoint of operative and spontaneous deliveries where mereurochrome was used it may be noted that beginning with a morbidity of 9.1 per cent for operative cases and one of 4.7 per cent for spontaneous cases, on the first Obstetrical Service, this had been reduced to a morbidity of 8.3 per cent for operative cases and one of 2.3 per cent for the spontaneous cases on the Second Obstetrical service.

The doctor showed other slides demonstrating the morbidity for the different operative procedures, such as version, placenta previa, high forceps, induction of labor and median episiotomy, with a morbidity of 4.1 per cent for the induction cases.

Following the exhibition of the slides, Dr. Matthews said the first point he would like to make was the efficacy of properly applied, mereurochrome as a vaginal and cervical antiseptic. Of course, in the secondary intrinsic infections in the old lacerated cervix where the infection is deep seated the germicide does not act so efficaciously as it does in the primiparous cervix where there is little or no previous infection. It does seem, however, that by more or less rendering aseptic the vaginal area we do minimize infections of the cervix.

The second point he had in mind was the immediate repair of both primary and secondary lacerations of the cervix, which should be more universally practised in hospital obstetrics.

The third point was that at the Methodist Episcopal Hospital, due to persistence of Dr. Mayes, we have developed a technic for the use of 4 per cent mereurochrome as a vaginal antiseptic which has reduced the morbidity 50 per cent or 8.8 per cent for the last 5000 cases.

DR. B. P. WATSON said he agreed with the speaker when he deplores the placing of all the blame upon nurses and doctors for every morbidity in pregnancy. Many cases of infection, especially minor infections, are probably intrinsic in origin, but he questioned whether the real virulent puerperal infection originates

from intrinsic organisms. Our own recent experience is that these very virulent infections are introduced from without by some means or other. That, however, does not exclude what Dr. Goodall has contended; namely, that the minor infections are probably due to organisms that harbor in the cervix.

Some three years ago in Edinburgh, a research on the organismal content of the cervix in pregnant women was made by Dr. Jessie Eals, who found that 60 per cent of multipara had streptococci of some sort in the vagina. There was no evidence, however, to show that those organisms were pathogenic organisms; they may have been potentially pathogenic, but the patients in whom they were found did not show any higher rate of morbidity than the average in the hospital.

Not only are organisms found in every cervix three or four days after labor, but in every uterus and in the neighborhood of the uterus four or five days after labor, so that we must regard these organisms as practically normal habitants of the vagina and of the puerperal uterus. It is, therefore, a very moot question as to what proportion of cases of infection are due to organisms which are there before delivery and what proportion are due to organisms introduced from without.

DR. W. P. HEALY said that what interested him particularly is the association between infections, postpartum, and any subsequent malignant lesion in the cervix. He believes, however, that the use of mercurochrome or any other form of safe mechanical and mild antiseptic cleansing of the vagina and freeing of the vagina of latent secretions that cause cervical irritation during the puerperium are very important, and that we can with advantage encourage the earlier use of mechanical cleansing of the vagina postpartum than is ordinarily carried out. Dr. Healy had never had any hesitancy about recommending vaginal douches postpartum as soon as the patient began to have any kind of foul or odorous lochial discharge.

One of the more important causes of foul lochia is the retention of urine in the vagina. The patient always attempts to void lying on her back on a bed-pan, she invariably puts a certain amount of urine into the vaginal canal.

From the standpoint of infections of the type that Dr. Goodall refers to in their relation to cancer, it is more important to know the condition of the cervix in the weeks when the patient is on her feet and going about and able to go to the physician's office for observation and treatment for any cervical erosion or laceration, more important to know what is going on and to treat it then than it actually is in the first two weeks postpartum. We do not know, however, what association there is between infected cervixes or lacerated cervixes and cancer of the cervix, beyond the fact that the vast majority of cases of cancer of the cervix occurs in married women and, therefore, in cervixes that have been subjected to damage, as Dr. Healy called attention to the rather infrequent occurrence of cancer of the cervix in women who have had badly infected cervixes of the venereal type, but who have not conceived; in other words, chronic endocervicitis without laceration, of venereal origin, is not necessarily going to be associated with carcinoma in the cervix to any great extent. That is to say, carcinoma of the cervix in prostitutes seems to be a rather infrequent disease. Then, we know the racial differences, the infrequency of cancer of the cervix in the Jewish women and the great frequency of cancer of the cervix in Italian women, in both of which races the cervix is very frequently injured, as much in one as in the other from childbirth.

DR. GOODALL, in conclusion, said: "In regard to Dr. Goff's immediate repair of the cervix, I would say that we practice it in a goodly number of cases, but singularly there is a very large percentage of cases where the external os seems to have suffered very slightly and yet the cervical canal opens up beyond the internal os into quite a large cavity, wherein the infection lurks. Those of you

who have cauterized the cervix in numerous cases have met with these cases where the external os, even after labor, has reduced itself to a very small opening and beyond this, when you get in, there is a large cavity which leads eventually in a fusiform manner to the internal os; so repair of the cervix is not, shall we say, a panacea for this condition, though I quite readily understand it is a subject in which we will eventually, perhaps, be criticised in years to come for not having repaired cervixes as today we are criticised for not having repaired the perineum.

"What Dr. Ward had to say about the reaction to labor is very interesting. The viewpoint which he expressed is one that appeals to one as rational, and yet Dr. Ward asks why should we not have a reaction after labor as well as after any other type of abdominal operation, for example, but it does not occur; that is the point. You can have multiparae and primiparae deliver themselves even with an episiotomy and with forceps and yet have an absolutely uneventful recovery without a fifth of a degree elevation in temperature."

Discussing further the question of morbidity following labor, Dr. Goodall referred to some studies that they had made which revealed the fact that in 60 per cent of the cases there was no morbidity, "not even a temperature above normal," that this was true of all types of cases, and stated that from the evidence which had been adduced by this particular survey, it was interesting to know why there should be morbidity in the other 40 per cent. Continuing along this line, the doctor said:

"After all, that is the clinical evidence; I cannot explain it, but it is a clinical fact, nevertheless.

"In regard to the treatment of the cervix during pregnancy, I think perhaps there is a field of activity there.

"I did not go fully into the subject of mereurochrome but if I had, it would read here that there is a very marked degree of lessened morbidity after its use, the stay of the patient in the hospital is lessened by a very considerable degree, and, altogether, the treatment is, I think, rational and certainly justifies the procedure.

"Dr. Vineberg spoke of a very important subject, namely: Does the hypertrophy which occurs in the uterus coincide with, or is it the result of fibrosis? In other words, is that similar to chronic metritis? No, it is not. Microscopically these two conditions can be differentiated absolutely. Every woman who has borne a child can be diagnosed, as can every woman who has had a pregnancy, by the microscopic sections of the uterine wall, whereas in the fibroid cases there is purely muscular and other tissue hypertrophy with no residuum of the former pregnancy.

"I quite agree with and I think I emphasized what Dr. Watson brought out; namely, that these infections are nearly all from organisms which have been latent in the woman for a long time and have become markedly attenuated. I quite agree with him also that any severe infection is extrinsic in character and therefore introduced."

## NEW ORLEANS GYNECOLOGICAL AND OBSTETRICAL SOCIETY

MEETING OF FEBRUARY 9, 1928

DR. A. H. GLADDEN, JR., read a paper on **Hemorrhagic Diseases of the Newborn**, with the report of a case successfully treated by the injection into the gluteal muscle of 10 c.c. of whole blood from the father.

DR. P. GRAFFAGNINO reported a case of **Ruptured Uterus**.

Patient, E. P., a pregnant negress of forty-five, was admitted September 9, 1927 in a state of collapse to the Charity Hospital. In the admitting room a diagnosis of pregnancy, with probable eclampsia, was made. About four hours prior to admission, she was suddenly awakened by severe lancinating pains just below the umbilicus, immediately succeeded by profuse perspiration, a sensation of cold and great weakness. While being transferred to the hospital, a small amount of blood flowed from the vagina. Her menstrual periods were always regular and painless; she had had three previous pregnancies. The first and second pregnancies terminated in normal deliveries, but the third delivery (six years ago) was by cesarean section. The puerperium in each instance was without incident and practically afebrile.

The pelvic measurements were normal; no fetal movements were palpated, there was no dilatation of the cervix and no uterine contractions, with slight vaginal bleeding and soreness over the abdomen.

A urinalysis (catheterized specimen) showed no casts or marked albuminuria. A blood picture revealed secondary anemia with slight leucocytosis and relative neutrophils. At 7 A. M. there was a decided improvement in her condition (blood pressure 100/70), but this was of short duration. In the afternoon her condition became desperate. At 5 P. M., when I saw the patient she was in a state of extreme shock; her pulse was rapid and almost imperceptible. On examination the abdomen showed a fetus, almost full term, under the skin; evidently a diagnosis of ruptured uterus was made.

When sent to the operating room a little after 7 P. M., her temperature was 101°, pulse 140, respiration 32. Infusion was started before the anesthetic was given. At 7:30 P. M., seventeen hours and forty minutes after admission to the ward, the operation was started. Under ethylene anesthesia, through a midline incision, a dead male fetus of about eight months, and the placenta were rapidly extricated from the abdominal cavity. The uterus had ruptured in the line of the old scar, extending from the internal os through the fundus. Because of the poor condition of the patient, it was felt that a Porro operation would not be justifiable, so the uterus was sutured outside of the cavity and the skin, according to the method of Portes. Two cigarette drains were introduced in front of the uterus in the space of Retzius, and the patient was sent to the ward with the usual orders for combatting shock. The operation terminated at 7:55.

Five hundred c.c. of blood as transfusion and 500 c.c. of normal saline as infusion, were given while the operation was in progress. Before leaving the table the patient was also given 1 c.c. of pituitrin. Pulse was good throughout, rate 120 to 124; after operation 120.

Patient had a rather stormy time during the two weeks following operation. For thirteen days the temperature ranged from 100° to 102°. Pulse irregular at times. Some gastric disturbance. Wound infection. Repeated examination of urine showed albumin present, often just a trace; once red blood cells were seen.

Patient's improvement dated from the thirteenth day after the operation; afebrile from that time until date of discharge. On the fourteenth day she was given soft diet. On the ninth day a gauze drain was substituted for the cigarette drains. On the twenty-second day the wound showed nice healing. It continued to heal rapidly, and the uterus to diminish in size. October 20 she was allowed to sit up in a chair and the following day was up and about the ward. She was transferred to a rest ward and kept there some time after she might have been discharged, but with an excellent result in her general condition and a wound completely sealed.

## BROOKLYN GYNECOLOGICAL SOCIETY

MEETING OF MARCH 2, 1928

DR. FRANCIS B. DOYLE reported a case of **Teratomas of the Ovary.**

*History of the Case.*—Mrs. L. K., twenty-seven years of age, admitted to Greenpoint Hospital (service of Dr. C. A. Gordon) complaining of severe pain in right lower quadrant of abdomen with vomiting and prostration.

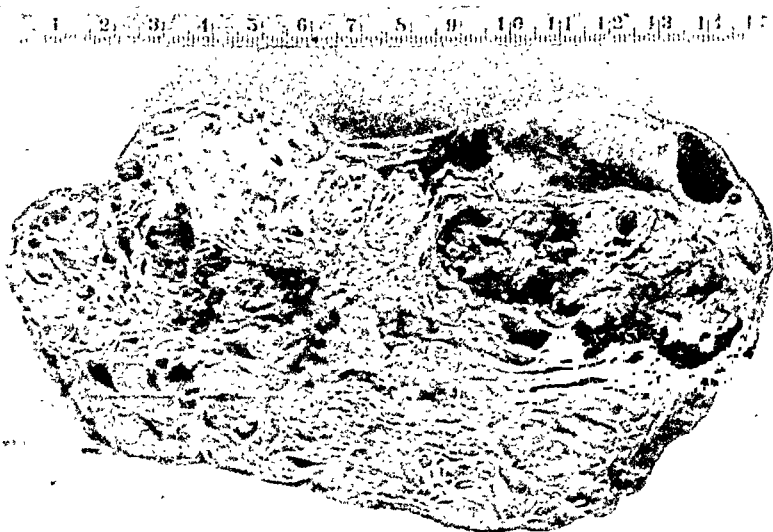


Fig. 1.—Cross-section reveals the typical anatomic structure of teratoma. Numerous closely set cysts are separated by bands of stroma. Focally cartilage is encountered.

Menses have been regular and painless, of twenty-eight-day type and one week's duration. Never had a miscarriage. Has had three children, two are alive, one died five hours after birth following forceps delivery. Nine months previous to admission had an attack of intense pain in right lower abdomen a few days after her menses. Since then has had a similar attack of more or less severity following each menstrual period. Two days before admission the seizure was more acute and violent, vomiting more frequently, with greater prostration and weakness, than any preceding one.



Fig. 2.—The cyst cavity is lined by ciliated epidermoid epithelium. The underlying stroma contains alveoli of salivary glands. The excretory ducts are also indicated.



Fig. 3.—Epidermoid epithelium, fat, and islands of cartilage are present, supported by mature stroma.

On abdominal examination a large tender globular mass was palpable in the right lower quadrant, but was not felt vaginally.

White cell count 9800. Polys. 88 per cent.

Abdomen opened through a median incision. The right ovary was a large cyst with two twists in its pedicle and tube. It was swollen and dark mahogany in color. It was removed and abdomen closed.

Recovery and convalescence were uneventful.

The specimen consisted of an ovarian cyst and attached tube.

The tumor was ovoid in shape 15 cm. long and 10 cm. in diameter. The surface was nodular, presenting numerous cysts of various sizes. On section, the specimen presented a solid tumor with multiple cyst formation. Microscopic examination showed a confused mixture of tissue growth. There were cysts lined with stratified squamous epithelium, and with columnar epithelium. There were many sebaceous glands, tubular glands, fat tissue, bundles of smooth muscle fibers, and cartilage. No malignant changes were seen.



Fig. 4.—Irregular gland spaces lined by ciliated epithelium are supported by embryonal connective tissue. An island of cartilage is encountered.

### DISCUSSION

DR. CHARLES A. GORDON said that the practical point in this discussion is that while cystic tumors are nonmalignant these solid teratomas are essentially malignant. This tumor, it is stated, seems to possess no characteristics of malignancy, yet that fact was discovered in the laboratory some time later.

There seems to be a difference of opinion whether a complete operation should be done or not in cases of this type, but it seemed to him that a complete operation should be done upon all these solid teratomas of the ovary without waiting for the diagnosis from the laboratory as to whether malignancy is present or not.

DR. SAMUEL A. WOLFE said that the gross pathology of the teratoma is beautifully reproduced in this specimen, a series of small cystic cavities supported largely by embryonal connective tissue. The dermoid in contrast, present

mature, fully-developed adult type of structures. For example, the skin in a dermoid is comparable to normal skin in any healthy individual. The connective tissue is comparable to the connective tissue in the organ. In the dermoid many of the tissues maintain and retain their adult character, while those of the teratoma are embryonal. It is because of this particular feature that teratoma of the ovary is, as a rule, associated with grave potentialities of malignancy. When these embryonal tissues undergo malignant degeneration we use the term blastomatous degeneration to indicate the malignant transformation of embryonal tissues. As a rule, we find that the mesodermal elements, the connective tissue element undergo malignancy rather than the ectodermal or entodermal derivatives.

Dr. Wolfe believed that in this particular tumor the embryonal elements, however, are only focally noted. The cartilage is well matured, the connective tissue and fat are well matured, and the endodermal derivatives are well differentiated, and we can practically trace the comparable organs from which those tissues are derived.

In this particular instance he considered that there will be no local recurrence or general metastasis.

DR. HAROLD BAILEY read a paper entitled **The Long Labor.** (For original article see page 324.)

#### DISCUSSION

DR. A. C. BECK said he disagreed with the speaker in regard to operative interference and the use of morphine. A few years ago he studied the same subject very carefully, both as to etiology and treatment. The occipito-posterior cases had longer labors than did the occipito-anteriors. Contrary to his statement, dry labors showed a much higher percentage of long labor. There were 27 per cent of long labors; that is, over twenty-four hours, in our real dry labors. Dr. Beck also noticed in a few cases of funnel pelvis cases that there was a tendency for the labor to be more prolonged than either in the generally contracted pelvis or in the normal pelvis. Fifteen per cent of the funnel pelvis, when the dry labor proposition as an etiologic factor was eliminated, had long labors.

Dr. Beck said he did not induce labor in contracted pelvis, and found in the toxic cases that more often than not the induced labor is prolonged.

In regard to the results in the conservative handling of these cases. In Dr. Beck's study there were 1138 cases, in which there occurred 79 prolonged labors. All but 13 of these delivered spontaneously. Some, of course, were in labor a long time, but the patients were not exhausted as a result of this, because when they grew tired they were given enough morphine so that they went to sleep. Sometimes they were given two periods of rest in the course of the labor. Forceps were used in only 6 cases. Two were delivered by breech extraction, and eight terminated by section; they were borderline types of contracted pelvis.

While he had not gone through the chemical investigations Dr. Bailey recommends, he stressed the need for the taking of large amounts of carbohydrates from the very beginning of the labor, and insisted upon the patients taking repeated feedings.



# Department of Reviews and Abstracts

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CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

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## Selected Abstracts

### Labor

**De Garis:** The Application of the New Definition of Normal Labor to the Clinical Study of Obstetrics. *The Australian Medical Journal*, 1926, ii, 6.

A new definition of normal labor as given by the writer is as follows: "A normal labor is one in which the uterine contractions act thoroughly efficient, leading in a short time to the spontaneous delivery of a healthy baby and causing but little or no distress or pain to the mother." The author believes that pain during labor is pathologic. She also considers that faulty diet may have an important bearing on the cause of pain during labor. Her theory further states that pain is probably the first indication of uterine inertia.

NORMAN F. MILLER.

**Ko Chi Sun:** Spontaneous Contractions of the Pregnant Human Uterus. A Preliminary Report. *Bulletin of Johns Hopkins Hospital*, 1925, xxxvi, 280.

Spontaneous contractions of the musculature of the pregnant human uterus have been studied graphically at all periods of gestation, and arguing by analogy with the lower animals and by the fact that spontaneous contractions were observed in the uterus of a six-month fetus, it must be assumed that the human uterus contracts rhythmically throughout life, certainly from before birth until after the menopause.

In pregnancy the contractions differ in various individuals in varying periods of pregnancy, labor, and the puerperium. Likewise, differences are noted according to the portion of the uterus from which the specimen is obtained, as well as according to the length of time it has been preserved outside the body.

The characteristic, passive behavior of the lower uterine segment has been demonstrated.

The various observations made may be offered in support of many clinical intra-vitam phenomena, such as the Braxton Hicks contractions, the after pains, secondary uterine inertia, tetanic contraction of the uterus in prolonged labor, ligneous consistence of the uterus associated with premature separation of the placenta, and the frequent occurrence of right occipito-posterior positions of the child.

C. O. MALAND.

**Jerlov, E.:** Does the Stimulus of Labor Arise in the Fetus? *Acta Obstetrica et Gynecologica Scandinavica*, 1926, v, 128.

In a series of experiments, the author found that the blood taken from the umbilical cord immediately after birth contains substances which promote the activity of a resected uterus of a guinea pig to a greater extent than does other blood even that from the mother. This finding is interpreted as indicating that the stimulus to labor under normal conditions originates in the fetus.

J. P. GREENHILL.

Wetterdal, P.: *The Fixation of the Fetal Head During the Latter Part of Pregnancy. A Comparison Between Primiparas and Multiparas.* *Acta Gynecologica Scandinavica*, 1925, iii, 297.

The author studied 250 primiparas and 250 multiparas in the obstetric clinic at Stockholm during the latter part of pregnancy. Only patients with occiput presentations and normal external pelvic measurements were selected. It was found that the fetal head was fixed two months before labor in about 25 per cent of primiparas and in about 20 per cent of multiparas. For each successive 10 days the relative numbers of fixed heads increased continuously, slightly more in primiparas. During the last three weeks it reached 55 to 57 per cent for all the cases. The author believes, therefore, that the mobility of the head during the last months of pregnancy does not necessarily denote a pathologic condition and that there is not much difference as regards this point in multiparas and primiparas. When labor pains begin the head becomes fixed much oftener in primiparas due to the different conditions of the lower uterine segment. The tonicity of the abdominal wall and the amount of liquor amnii do not seem to play any part in the fixation of the head except in extreme cases.

J. P. GREENHILL.

Guérin-Valmale and Lorient: *Does the Uterus Descend Toward the End of Pregnancy?* *Bulletin de la Société d'Obstétrique et de Gynécologie de Paris*, 1925, xiv, 397.

It is the general belief that the uterus descends into the pelvis during the last weeks of pregnancy but the authors claim this is a misconception. They base their contention on the measurements of 420 women who had no abnormalities which might interfere with this study, such as polyhydramnios, placenta previa, pelvic tumors, twin pregnancies, etc. In this series the authors found a continuous rise of the uterus even to the very end of pregnancy. The height of the uterus remained the same for equal durations of pregnancy regardless of whether the head was movable or fixed. Descent of the fetal head does not cause descent of the uterus for the following reason: When the head is movable it has below it in the lower uterine segment a certain amount of liquor amnii; when the head descends the liquor is displaced upward so that the uterine height is not changed.

Toward the end of pregnancy patients usually say the uterus has dropped. What has actually happened is that the uterus has inclined itself forward, thereby relieving pressure in the epigastrium and giving the patient more freedom in respiration. The jutting forward of the uterus is due to the fact that as the uterus grows, it becomes harder and approaches more nearly the shape of a sphere. As this happens it recedes more and more from the spinal column, against which it rests in the early months. The phenomenon is more noticeable in primiparas because in them the uterus has more tonicity and is therefore harder. While the above holds true for the large majority of cases, there is a lowering of the uterus in a small percentage (about 6 per cent).

J. P. GREENHILL.

Bretz, M.: *Axial Rotation of the Uterus During Labor.* *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxix, 20.

A cesarean section was performed on a 21-year-old primipara with a contracted pelvis in whom the fetal head was firmly fixed in the right lower quadrant. The abdominal incision was made in the midline between the umbilicus and the

symphysis and upon opening the peritoneal cavity the right tube and ovary presented themselves. This condition was produced by a 180 degree rotation of the uterus toward the left side. The uterus could not be rotated back to the right side. Since the posterior wall of the uterus was the only accessible one the peritoneum on the posterior surface was incised transversely and stripped away and the uterus was incised longitudinally in the lower uterine segment and lower part of the fundus posteriorly. The child was delivered with forceps. After the uterus was closed, it spontaneously turned back to its normal position. The patient recovered.

This patient had no symptoms referable to the rotation of the uterus and absolutely no pain other than uterine contractions. The author could find no explanation for the rotation.

J. P. GREENHILL.

**Weinzierl, E.: Indirect Determination of Cervical Dilatation According to the Schatz-Unterberger Method.** *Medizinische Klinik*, 1924, xx, 1458.

The Schatz-Unterberger method of determining the amount of cervical dilatation depends on the height of the ring which exists between the fundus and the lower uterine segment, because the amount of dilatation of the cervix is influenced by the relationship which exists between the active, contracting part of the uterus and the passive, dilating portion. For normal cases the relationship between the cervix and the retraction ring is fairly constant but where there is some obstruction, the ring may rise very high while the cervix may dilate very little. The author studied 100 women in labor by means of this method. The abdomen was palpated not only between pains but also during pains and at the beginning of the study the results were checked up by rectal examinations. In nearly all cases the amount of cervical dilatation could be foretold by estimating the height of the retraction ring above the symphysis. In primiparas the ring was more pronounced than in multiparas. The method proved especially valuable where internal examinations could not be done as in cases where colpeurynters or metreurynters were used. The author found that the test was not only applicable in normal cases but also in abnormal ones, contrary to the findings of other writers.

J. P. GREENHILL.

**Koller, T.: The Importance of Rectal Examinations During Labor As a Prophylaxis Against Puerperal Infections.** *Archiv fuer Gynäkologie*, 1925, cxxvii, 1.

The author reports two series of obstetric cases, each consisting of 4917 cases in labor, the one group being examined only rectally and the other being examined vaginally at some time during labor. The percentage of cases in each group which showed a rise in temperature one or more times after delivery was practically the same. Neither was there any difference in the mortality rate of the two groups. There was, however, a marked difference in the incidence of periuterine wound infections in the two groups. In the group examined only rectally, this incidence was 0.05 per cent, while in the group examined vaginally this condition was found in 0.34 per cent of cases, which is six and one-half times as frequently as in the other group. The author believes that this difference is due to the fact that in the cases examined vaginally, organisms from the vulva are carried up into the cervical canal by the examining finger and so into the uterine cavity. Rectal examinations only, of course, are a prophylaxis against the carrying of organisms from the vulva into the uterine cavity and, therefore, is a prophylaxis against periuterine infections during the puerperium.

RALPH A. REES.

**Belosor:** The Anatomic Basis of the Rupture of the Membranes in Normal and Premature Births. *Zentralblatt für Gynäkologie*, 1925, xlix, 644.

After histologic examination of the amnion in 50 cases the writer comes to the conclusion that hyaline degeneration of the amnion is a physiologic process tending to simplify the rupture of that membrane during birth. This degeneration increases with the age of the fetus, reaching a maximum between the eighth and tenth months. Where the fetus has been born with intact amnion the degeneration is noted to be less marked. Rupture of the sac is due not only to contraction of the uterus but also to the fragility of the tissues.

LITTLE.

**Gold, Victor:** Diagnosis of Ruptured Membranes. *Zentralblatt für Gynäkologie*, 1927, li, 1491.

Due to the alkalinity of the amniotic fluid the chemical reaction of the vaginal secretion changes from acid to alkaline after the rupture of the membranes. By testing the vaginal secretion with litmus paper it is possible to determine with accuracy whether the membranes have ruptured or are still intact. Sources of error include the alkaline reaction of bloody secretion, of antiseptics, soap, and the acid reaction of acid urine.

GROVER LIESE.

**Rosenstein, W.:** Cervical Lacerations in Spontaneous Labors, *Monatsschrift für Geburtshilfe und Gynäkologie*, 1927, lxxvi, 265.

The author believes that strong bearing-down efforts during the first stage of labor favor the occurrence of cervical lacerations. Likewise pressure on the fundus externally before the cervix is completely dilated is harmful. Where bleeding or other evidence of cervical laceration is present, the cervix should be carefully inspected and repaired if tears are present. Just as unrepaired or badly repaired perineal lacerations must subsequently be operated upon so do unsutured or badly sutured cervical lacerations later require plastic operations.

J. P. GREENHILL.

**Hinselmann, H.:** The Damage of the Lower Uterine Segment in Spontaneous Deliveries, Based Upon Systemic Colposcopic Examination in the Puerperium. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1926, lxxii, 43.

Hinselmann examined the vaginas of a large number of patients during the puerperium to see the damage labor had produced. Nearly all the injuries were in the cervix and in the introitus. Isolated lacerations in the vagina were rare and most of them were in the middle third of the vagina on the left side. A frequent finding was injury to the vestibule, especially in the region around the urethra and clitoris and these were in the form of bruises. They were most likely due to the strong pressure of the fetal head as it passed through the outlet. Forced protection of the perineum greatly increased these injuries.

Lacerations of the cervix were not very common. The tears were often multiple and were usually  $\frac{1}{2}$  to 1 cm. long. Most of them looked clean. A not uncommon bruise was found in the anterior lip of the cervix about  $\frac{1}{2}$  to 1 cm. above the external os. The author believes that all puerperae who do not have fresh repairs should have a vaginal examination with a colposcope.

J. P. GREENHILL.

Howat, R. K.: The Perineal and Pelvic Floor Muscles in the Second Stage of Labor. *British Medical Journal*, 1927, i, 759.

The teaching, express and implied, that during the pains of the second stage the perineal muscles are in a state of contraction seems opposed to some obvious phenomena of labor. A little consideration of the conditions of the second stage compared with the effects of contraction of perineal and pelvic floor muscles will serve to indicate the difficulty of accepting this teaching.

It appears that during the pains of the perineal "management" stage the muscles of the pelvic floor and perineum are stretched, as indeed are all the perineal tissues. They are not contracted, and therefore it is not true that their contraction opposes delivery and favors laceration.

F. L. ADAIR.

Hall, Rosetta Sherwood: Posture in the Preservation of the Perineum. *China Medical Journal*, 1927, xli, 797.

The author's attention has been called to the comparatively few torn perineums among Korean woman who have visited the gynecologic departments in Seoul and Chemulpo, and also in Pyong Yang. Among some 3000 patients, about 75 per cent were delivered upon their knees, a Korean custom. Of these 55 per cent had no tears; the remaining 20 per cent were torn a little, and they usually gave a history of a too rapid labor. Of the entire number, 25 per cent were delivered with the mother lying upon her back, and they were almost always torn, some quite badly; only 3 per cent of the number delivered that way had no tear. With a few exceptions those delivered upon the back had been attended by either a midwife or a physician. Of course, they may represent more difficult or abnormal cases. It is stated that 20 to 30 per cent of primiparae receive a perineal tear in hospital practice in the United States.

From observation the author believes that delivery in Sim's position is but an adaptation of the Korean custom to better suit our beds or delivery tables. In their homes, upon the Korean floors, the midwife prefers to deliver patients upon their knees. It is the ordinary position of the pelvis in the labor of four-footed animals. Perhaps more research in the customs of primitive peoples will reveal that Korea has not been alone in this safe custom.

C. O. MALAND.

Abel: On The Combating of Weak Labor Pains. *Deutsche Medizinische Wochenschrift*, 1925, li, 1953.

Abel has tried the many German and English preparations from the pituitary gland and finds that they are not uniform in their action on the uterine musculature. He has decided that "Pituitan Forte," made by Henning in Berlin, is the best. He uses it to stimulate the uterine contractions when they are failing in any case, with the provision that if the head is not in the pelvis or there has been an early loss of the amniotic fluid, the cervix must be fully dilated before "Pituitan" is given. He has also used it in functional bleeding from the uterus with excellent success.

PEMBERTON.

Bell, W. Blair: Infundibulin; Indications for its Use in Surgical and Obstetrical Practice. *British Medical Journal*, 1925, i, 1027.

Infundibulin or pituitrin is of use in three types of obstetric conditions: For the induction of labor; for uterine inertia; and at the end of the third stage of

labor. For the induction of labor it is indicated first, to bring about the expulsion of the dead fetus; second, in postmaturity to obviate the possibility of disproportion between the maternal and fetal parts; and third, in antepartum hemorrhage either accidental or from placenta previa when used with other methods such as rupture of the membranes. To induce labor 0.5 gm. is given 4 times daily for about 3 days in order to bring about uterine contractions.

In a case of physiologic primary inertia in a primigravida pituitrin should not be given, but rather a sedative. Pathologic primary uterine inertia usually occurs with multiparity and is normally due to an insufficient amount of so-called pressor substances in the blood to bring about normal and forceful uterine contractions. In this type of case pituitrin should be given.

In secondary uterine inertia we have a fully dilated cervix but normally an exhaustion of the uterine musculature with pains too weak to bring about the spontaneous delivery of the child. In this type of case pituitrin is useful but must be employed with caution and the patient watched closely.

At the end of the third stage, following the expulsion of the placenta, pituitrin should be given followed by the administration of ergot. It should be given after cesarean section after the uterine wound has been sutured. It is also of use for subinvolution of the uterus.

Pituitrin is a powerful drug which is of great benefit to the obstetrician when used with caution and by one who understands its indications and limitations.

ADAIR AND SICHEL.

**Bey:** The Use of Pituitrin in Obstetrics. *Bruxelles Médical*, 1925, v, 1183.

Bey feels that in pituitrin the obstetrician has a valuable adjuvant which, when used intelligently, carries with it no danger. Its use should be reserved for those cases where, after complete cervical dilatation, the presenting part having descended well into the pelvis, secondary inertia develops. It should never be used where disproportion between the pelvis and fetus exists. If these contraindications be observed the necessity for forceps will be reduced 75 per cent without danger to the fetus. He emphatically asserts, however, that the abuse of pituitrin should be energetically combated.

THEODORE W. ADAMS.

**Scott, R. A.:** Pituitrin and the Third Stage of Labor. *Surgery, Gynecology and Obstetrics*, 1926, xliii, 651.

In order to estimate the value of this procedure, the records of 1000 consecutive cases in which pituitrin was used were reviewed and the results compared with 1000 consecutive cases in which pituitrin was not used.

Pituitrin was administered intramuscularly in dosage of one-half c.c. at the beginning of the third stage of labor and it was found: (1) It definitely shortened the third stage of labor. (2) It lessened the amount of blood lost in the third stage of labor both in spontaneous and operative deliveries. (3) It lessened the number of cases of postpartum hemorrhage, and (4) diminished the frequency of retained placentas due to constriction ring.

WM. C. HENSKE.

**Oppenheimer, W.:** Subcutaneous Emphysema of the Parturient Woman. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1925, lxx, 243.

The occurrence of subcutaneous emphysema during labor is rare, there being only 9 case reports in the German literature since 1875. Kosmak was able to

collect 77 cases from the entire literature. Oppenheimer reports a case of a primipara in whom subcutaneous emphysema occurred after a spontaneous labor which had lasted thirty-four hours. About three hours after labor the patient complained of pain in the neck and face and these parts of the body were found to be definitely blown up. Crepitation was easily obtained. The condition soon extended over the shoulders and down the chest to the nipples. Most of the emphysema disappeared after two days but some was still present on the eighth. Aside from mild pain there were no symptoms at all. X-ray showed normal lungs. The emphysema in this case was due to strong bearing-down pains after a long labor. The baby was large and the pelvis was flat.

Nearly all the patients whose cases were reported in the literature were primiparas. The mechanism of the origin of the subcutaneous emphysema is as follows: In a primipara strong bearing-down pains produce increased pressure within the alveoli of the lungs. One or more alveoli rupture and the air escapes into the interstitial tissue, producing an interstitial emphysema. With each bearing-down effort more air becomes interstitial and is forced along the branches of the bronchioles toward the hilus. From the hilus the air easily escapes into the loose mediastinal tissue high up, and so reaches the subcutaneous tissue in the region of the jugular vein or the median part of the clavicle. From here the air spreads further in all directions. Thus far there has been only one death reported from subcutaneous emphysema in a parturient woman.

J. P. GREENHILL.

**Moyes, R. E.: Full-Time Pregnancy in Bicornuate Uterus.** *British Medical Journal*, 1925, ii, 256.

The author describes the case of a primipara, twenty-eight years old, with a long labor (twenty-four hours), position O.L.A., and having a tumor on the left half of the uterus. The author waited one and one-half hours for the placenta, then decided to do a manual removal. He found a muscular septum dividing the uterus with the placenta adherent on the right side. Recovery was uneventful except for profuse, foul lochia for one week.

ADAIR AND HACKETT.

**Vidal: Tachycardia and Arrhythmia Following an Injection of Pituitary Extract During Labor.** *Bulletin de la Société d'Obstétrique et de Gynécologie*, 1928, xvii, 35.

A secundipara was given a hypodermic of one-half c.c. of pituitary extract after the cervix had been completely dilated for a half hour, and the pains had ceased completely. Instantly and before the uterine contractions reappeared, the patient's pulse rose to 140-150 and was very irregular. Her face became extremely pale and anxious. Then the uterine contractions began and the child was expelled alive. The arrhythmia disappeared at once but the tachycardia persisted and did not diminish until 12 hours after labor. The puerperium was normal. Examination of the patient's heart revealed no abnormality, her blood pressure was normal and there were no hyperthyroid symptoms. The sudden appearance of the alarming symptoms after the injection of the pituitary extract leads to the belief that the injection was not made in the muscle but in a vein. The prolonged tachycardia, however, remains unexplained.

J. P. GREENHILL.

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## Original Communications

AMERICAN GYNECOLOGICAL SOCIETY\*

FORTY-EIGHTH ANNUAL MEETING

PRESIDENT'S ADDRESS

BY JOSEPH BRETTAUR, M.D., NEW YORK, N. Y.

THE privilege of addressing this meeting as its president is one which I appreciate deeply. Will you allow me to express to you my sincere thanks for this honor, as unexpected as it was undeserved?

Presidential addresses offer extraordinary opportunities; one is not confined to consideration of professional matters or to science, but may admonish, philosophize or air pet theories; in short, talk about anything if only it is brief.

My predecessors have in their annual addresses fully covered the ground of our achievements and failures, our hopes and ambitions. An organization of forward looking men has been built up, strengthened from time to time by additions from the younger group, eager to do honor to our profession, and turning often from the beaten path to original and fruitful lines of endeavor.

My subject today, *A Point of View*, is strictly speaking not a medical one, but one with which we gynecologists may well concern ourselves. This point of view has to do with the famous one of Sir William Osler concerning age and mental activity, which has had such an enormous influence. I have in mind his idea of the crisis supposed to occur in individuals at the age of forty, not the misinterpretation of his statement concerning men of sixty. He believed that about the age of forty, a definite change takes place in the human mind, with

\*The papers included in the current issue were presented at the last annual meeting of the American Gynecological Society, held in Washington, D. C., on April 30, May 1, and 2, 1928. It is not possible for lack of space to include in this number the entire program of this meeting and the remaining papers together with the abstracted discussions will appear in subsequent issues of the Journal.

NOTE: The Editor accepts no responsibility for the views and statements of authors as published in their "Original Communications."



an actual loss in mental capacity, in consequence of which the performance of any new or creative function is not possible. The general widespread belief (which is often justified) is that middle-aged people are not qualified to undertake new jobs; that as a rule they are set in their ways and lack the ability to change their habits.

It is this point of view that I want to challenge. I want to show the value of the opposite concept, with its bearing upon the lives and problems of men and women.

The human mind has two functions, memory and the ability to reason. Every other mental activity depends upon these two functions. So-called original thinking is only the use of these along selected lines. Learning by rote is easier in youth because memory is then at its best, but real learning is the result of experience and the power to reason, and both of these increase with age. Let us grant that memory may, and frequently does, become weaker with age; the rôle played by memory, however, has become less and less important with the lapse of time. In Dante's day it was possible for one man to know everything, but the known facts in the world today are so overwhelming in number that no one man can know them all. Thus from the point of capacity, there is no valid reason why the human mind after the fortieth year should not function as well if not better than before.

There are many examples of great mental activity late in life; Cato learned Greek at eighty; Pasteur did his epoch making work after fifty; Michelangelo did his magnum opus at the age of ninety; Goethe finished *Faust* at eighty; the telescope was invented by Galileo in his seventy-third year; Titian painted one of his most celebrated pictures, "The Battle of Lepanto," at ninety-eight; Oliver Wendell Holmes is today at eighty-seven one of the most active members of our Supreme Court; Weir Mitchell turned to successful literary work after seventy, and Foch, Generalissimo of the Allies, at seventy conceived and executed the strategic movements which brought the World War to a close.

Could the ordinary man do these things? Are all these men exceptions? A closer study of their lives and of the impetus and influence which stimulated them to these achievements is necessary before it can be said that they *are* exceptions.

Osler was a keen observer and he saw that the average man does cease to progress after forty. It appears to me, however, that while he was right as to the occurrence of this stasis in the average individual, the examples that can be cited of accomplishment late in life, and the analysis made of the functions of the human mind, show that the reasons for this occurrence are not what he thought they were.

If we consider the factors in the life of the average man, another possible explanation can be found. Up to the age of forty or there-

about, the average individual is occupied with earning a livelihood; almost everything he does is subordinated to this main end, with the result that when he reaches the age of forty, his habits of life are fixed and he has come to think, day by day, in a stereotyped way. He regards himself as middle-aged, as settled, and expects little change in the course of his future life. Without some unusual stimulus the habits of thought and mode of life thus acquired will not change; it is the unusual stimulus which creates the exception. Whatever the nature of the stimulus may be, we may assuredly say that the point of view which makes a man believe that he is old and settled at forty is *not* an impetus to further development; but the idea that growth and development of the mind right on through life is not only possible, but has taken place repeatedly, is on the other hand a powerful impetus to future progress. I believe firmly that if this were generally recognized, we would see the average person accomplishing to a far greater degree that which now seems possible only for the exceptional individual. We as physicians can do much to promote this idea.

If the law of ratio of adolescence and duration of life holds true, and if the elephant who matures at forty lives to the age of two hundred, and the dog maturing in two years lives to the age of ten, then man who matures at the age of twenty should live to the age of one hundred. We have not, however, achieved this biologic standard; perhaps we have in some way degenerated physically, although this is not supported by statistics. About the year 1600 the expectancy of life was between twenty-five and thirty years; at the end of the last century it was from forty-two to forty-four years, and now statistics show it to be fifty-seven years. Now as between a possible one hundred and the actual fifty-seven, let us take as a working scheme the Biblical three score and ten. If instead of believing that we cease to progress at forty, we realize that after this age we may have the optimum period for mental growth and achievement, is it not reasonable to suppose that many of the unfulfilled dreams and possibilities of the average individual can and will be developed?

This outlook is of special importance to women, and so may be considered a matter of interest to us as gynecologists. Up to recent times woman was concerned entirely with domestic and social duties. Our mothers and grandmothers married young, kept house, and brought up their children; at forty their work was finished; they sat down by the fireside and were old. Within the last few decades great changes have taken place; with the political, economic, and educational freedom of women, the world is open to them. The family is no longer the only and absorbing interest in their lives; it has become fashionable to have a career. The difficulties encountered are many. The care of a family takes much time and attention, so does the profession or business. Those who try to do both sooner or later (usually

sooner) fall by the wayside and form the gross of the busy practitioner's clientele. It is apparent that one or the other must be neglected.

How can women combine the care of home and children with an active life outside the home and do justice to both? In view of the possibilities of mental development later in life, the solution becomes less difficult. A woman who marries young may look forward after her family is established to a period of twenty or thirty years when she will have considerable leisure, when her mind and capacity will be at their best, and when she can become expert along whatever line her natural bent may lead her. Looking forward to this period in her life, she can try to discover as early as possible, even while conscientiously devoting herself to her family, in which direction this bent lies, and by any available means carry the thread of her interest through the decades of her domestic life so that she will be prepared for the time when she will have leisure to intensify her work.

We have all observed the fate of the woman whose children are grown up and no longer need her, and who has no other training than her domestic one. Her job is gone, leaving her full of undirected energy, her nervous equilibrium in need of support and the remainder of her life empty. So often we find at the bottom of the trouble maladjustment in her scheme of life and an unsatisfactory use of her energies.

I believe that by fostering the idea that life after forty is the ideal time for full development of the individual, that many of these capable women will be benefited and that some of our problems will be solved. We gynecologists, with the authority of our profession, can do as much if not more than the educators to advance this point of view.

## ENDOMETRIOSIS FOLLOWING SALPINGECTOMY

By JOHN A. SAMPSON, M.D., ALBANY, N. Y.

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THE name, endometriosis, was used by me<sup>1</sup> to indicate conditions arising from both misplaced uterine and tubal mucosa, even though I realized that it was not strictly correct in the latter. At the time it was stated that müllerianosis would be an inclusive and a correct term. Unfortunately, it suggests an embryonic origin, does not specify its derivation from mucosa and is not as descriptive as endometriosis. Objections were made to the names, endometrioma and müllerianoma, given by Blair Bell<sup>2</sup> and Bailey<sup>3</sup> respectively, because it did not seem to me that these lesions could be classified as true neoplasms. The invasion of the uterine wall by its mucosa is an excellent example of an endometriosis, but this name could not correctly be applied to the conditions resulting from the invasion of the tubal wall by its mucosa. Endosalpingiosis would be correct in the latter. The same confusion arises in the nomenclature of the implantation-like lesions of müllerian mucosa involving the peritoneum, because there is strong circumstantial evidence indicating their origin from both uterine and tubal mucosa. In my earlier studies of peritoneal endometriosis, I thought that one could often determine whether given misplaced endometrium-like tissue was of uterine or tubal origin. If it had the histologic structure of the glandular elements of a direct endometriosis, it was of uterine origin; if that of a direct endosalpingiosis, it was of tubal origin. Later studies convinced me that misplaced endometrial tissue, at times, may simulate tubal mucosa and misplaced endosalpingeal tissue may simulate uterine mucosa, so that the source of the glandular elements in these lesions cannot with certainty be determined by their histologic structure.

The incidence of endometrium-like tissue in the abdominal scar after cesarean section was utilized by me<sup>4</sup> to support the theory that peritoneal endometriosis, at times, might arise from the implantation of bits of uterine mucosa escaping into the peritoneal cavity. In the discussion of this paper, Cullen<sup>5</sup> reported three cases of postoperative endometriosis of the abdominal scar and he expressed his belief that they arose from endometrial tissue transplanted by the surgeon.

In more recent years several cases of endometrium-like tissue in abdominal scars have been reported and many of these followed operations where the uterine cavity had not been incised. These cases have influenced the supporters of the serosal theory of the origin of perito-

neal endometriosis to claim that the endometrium-like tissue of laparotomy scars arises from the inclusion of bits of the peritoneal serosa in the wound and its subsequent transformation into müllerian mucosa rather than from the growth of bits of müllerian mucosa transplanted by the surgeon.

Nicholson<sup>6</sup> has recently written an excellent paper, *Endometrial Tumors of Laparotomy Scars*, supporting this theory. He has carefully studied the principal cases which he found in the literature and has given abstracts of these. They include those reported by Meyer, Klages, von Franqué, Fraas, Cullen, Mahle and McCarty, Lauche, Tobler, Lochrane, Lemon and Mahle, Rosenstein and one of his own.

He groups these cases according to the nature and purpose of the original operation, as follows:

1. Ventrofixation of the uterus, fifteen cases.
2. Operations for perforation or rupture of the pregnant uterus, two cases.
3. Hysterectomy, one case.
4. Operations on the fallopian tubes or ovaries without hysterectomy, six cases.
5. Operations on the uterine ligaments, one case.
6. Appendicectomy, two cases.
7. Abdominal incision and drainage of suppuration in the pelvis, one case.

The anatomic continuity between the epithelium of the uterine mucosa and that of the tumor of the abdominal wall was not established in a single instance in the cases collected by Nicholson. He states that these tumors may be explained with the help of one of three theories. "It is assumed that the tumor arises either in a cell rest which was displaced in development or in a fragment of endometrium displaced in adult life or by proliferation and changes of type of epithelial cells of the peritoneum."

He concludes that

"1. Endometrial tumors are acquired accessory uteri.

"2. Of the theories which attempt to explain them the 'peritoneal' is the most generally applicable and its acceptance offers the fewest difficulties. It alone agrees with biological facts."

Novak<sup>7</sup> questions the origin of the endometrial tissue in abdominal scars by transplantation. He mentions a case reported by Pankow where such a condition developed in the abdominal scar of a woman at the age of thirty, following the removal of the appendix when she was a child. He reports a case of his own containing typical endometrium following the removal of one tube and ovary. He does not believe that there is sufficient evidence for assuming that these cicatrix endometriomas are due to the actual transplantation of endometrial tissue, especially in cases where the uterus is not entered at operation. On the other hand, he states that this possibility cannot be denied. He believes that the arguments which he has set forth in his paper

speak for the possibility of the origin of such growths from the coelom-derived peritoneum, as with similar growths elsewhere in the peritoneum.

I have been interested in endometriosis of laparotomy scars for several years, but had not had an opportunity to study a case of my own until September, 1926, when I encountered one following ventrofixation of the uterus after cutting and ligating both tubes.

If tubal sterilization or salpingectomy is ever in any way responsible for the presence of müllerian mucosa in the abdominal scar, we would expect frequently to find endometriosis of the tubal stump and also of adjacent or adherent structures following operations in which the tubes have been removed or cut and the uterus retained. If it is true that the müllerian mucosa in abdominal scars, following salpin-

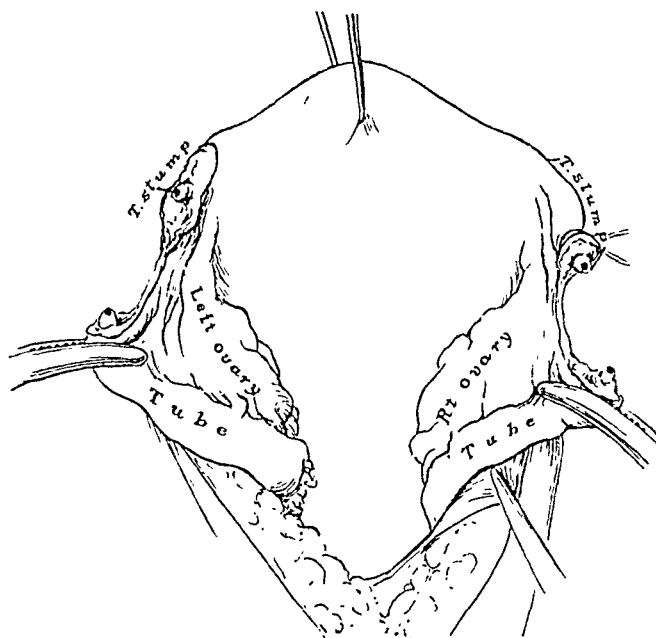


Fig. 1.—Treatment of the tubal stump after salpingectomy (x 2/3.) Some operators excise a part of the interstitial portion of the tube and bury the stump in the uterine cornu. Others remove the tube distal to the uterus and ligate the stump without attempting to bury it. On severing the tube its walls retract, thus exposing the traumatized mucosa. Bits of the latter may be transplanted, during the various procedures incident to salpingectomy, in the immediate and also in more remote operative fields. The results of the cultivation of tubal mucosa in women, which has been initiated by salpingectomy, may be determined by the histologic study of tubal stumps removed at a subsequent operation.

gectomy, arises from a transformation or differentiation of bits of the peritoneal serosa included in the abdominal wound, as claimed by the supporters of the serosal theory for peritoneal endometriosis, the endometriosis of the tubal stump and neighboring pelvic structures should have a similar origin. If it can be shown that the endometriosis in the latter structures, at times, arises from tubal and uterine mucosa by direct extension and transplantation, a similar origin, at times, might account for the müllerian mucosa in laparotomy scars following salpingectomy.

Since September, 1926, we have been studying the results of salpingectomy and tubal sterilization. Salpingectomy was done on many uteri after their removal. In some the tubal stump was buried in the uterine cornu and in others it was ligated (Fig. 1). In burying the tubal stump care was taken, in some instances, to avoid piercing it with the needle carrying the suture, and in others it was purposely transfixed to determine the result of drawing the bungling doubled catgut suture through the traumatized tube. On severing the tube its muscular walls retract, the mucosa is exposed (Fig. 2) and bits of the latter apparently may be unintentionally transferred by the surgeon to various parts of the field of operation. This chance is increased if the tube is clamped or ligated near its cut end. The transfixing of the tubal stump by a ligature apparently is an efficient way to dis-



Fig. 2.—Photomicrograph (x 10) of a longitudinal section of the stump of a severed tube. Its walls have retracted and its mucosa is exposed like the crayon of a sharpened pencil. The tubal mucosa may be further traumatized by clamping or ligating the stump. In the healing of such a stump the traumatized and exposed mucosa often grow out as sprouts which may invade any organ or structure adherent to the stump.

seminate bits of the tubal mucosa. This experimental material was hardened in formalin and examined histologically in order to ascertain the immediate results of operative trauma on the tube and the possible finding of bits of tubal mucosa in the operative wound. The latter were found in 16 out of 42 tubal stumps studied in this manner (Fig. 3).

I have often observed blood escaping from the abdominal ostia of tubes when the abdominal operation has been preceded by a curettage of the uterus. Bits of the uterine mucosa have been found in the lumen of tubes removed in these operations. After cutting across the uterine end of the tube, blood, at times, may be forced from the cavity of the curetted uterus through the lumen of the cut tube as from

the nozzle of a rubber syringe (Fig. 4). In one instance a bit of tissue was seen to "pop" out of the lumen of the tube. This was picked up on the point of a knife, hardened and sectioned and proved to be a bit of uterine mucosa. Melted gelatine containing barium sulphate was injected through the cervix into the cavities of uteri removed by operation before experimentally removing the tube. It was found that this injection mass often escaped from the severed uterine end of the tube, just as blood escapes through the severed tube when the abdominal operation has been preceded by a curettage. Uteri removed by operation were curetted and the cavity filled with water, cervix clamped and then salpingectomy done. Observations at operation and by experiment demonstrate that in salpingectomy the tube is traumatized and, at times, bits of the tubal and uterine mucosa are transferred by the surgeon to various parts of the field of operation, such

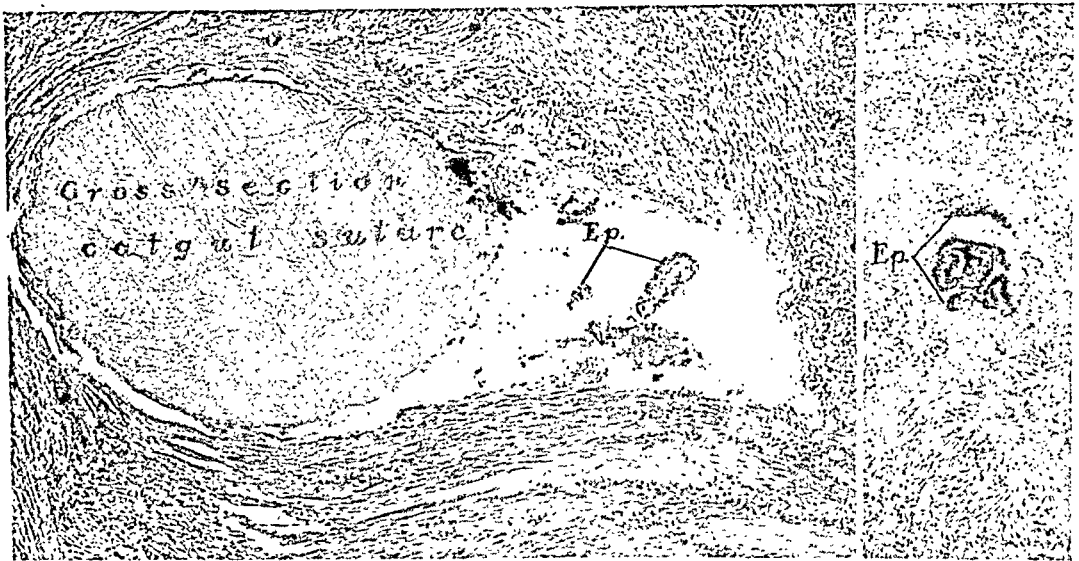


Fig. 3.—Two photomicrographs (x 60) showing "tubal epithelium" transplanted in the uterine cornu during salpingectomy and the burial of the stump. The immediate results of salpingectomy were studied by performing that operation on uteri which had been removed. Fragments of tubal mucosa were found in 16 of 42 specimens, so studied. If tubal epithelium thus transplanted should live, we would expect to find seedlings in and about the tubal stumps removed at the second operation. These seedlings were found.

as the tubal stump, the uterine cornu, the pelvic structures about it and even the abdominal wound. In performing the "toilet" of the peritoneum and in the closure of the abdominal incision after salpingectomy, the surgeon may unknowingly cover the transplanted bits of tubal mucosa, as carefully as in the experimental work of Jacobson<sup>8</sup> and others in their successful autotransplantation of müllerian mucosa in lower animals. What are the results of these unintentional experiments in the cultivation of müllerian mucosa in women? A knowledge of the nature of the original operation and the histologic study of the tubal stumps and the surrounding structures obtained at the second operation enable us to determine these results.



The method of studying these cases was as follows:

1. If hysterectomy was indicated at the second operation, great care was exercised to remove any tissue adherent to the uterine cornu or tubal stump together with the uterus. If hysterectomy was not indicated, the same care was employed in excising the uterine cornu containing the tubal stump.

2. The uterus or specimen to be studied was hardened in formalin. If the specimen promised to be of unusual interest, sketches were made of it before cutting the blocks for histologic study.

3. The blocks were embedded in celloidin and the permanent sections were stained in hematoxylin and eosin.

4. The entire course of the lumen of the tube in the stump was followed and its relation to any misplaced müllerian mucosa was determined. By carefully watching the surface of the block, as the sections are cut, one could usually see

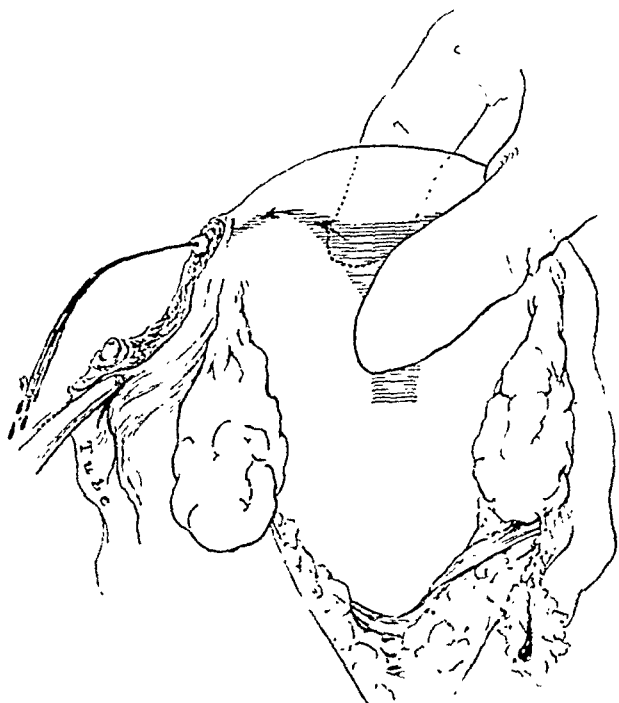


FIG. 4.—If an abdominal operation has been preceded by a curettage of the uterus, blood frequently may be seen escaping from the abdominal ostia of the tubes. If salpingectomy or tubal sterilization is done, blood, at times, may be forced from the cavity of the curetted uterus through the lumen of the tubal stump as through the nozzle of a rubber syringe. Bits of uterine mucosa have been demonstrated in this blood. This represents one way by which uterine mucosa may be transplanted during these operations.

the tube, follow its course, detect an endometriosis, if present, and determine its relation to the mucosa of the tube. The effect was that of watching a slowly moving motion picture. The first complete section was stained, floated on a slide and examined with a hand lens or under the low power of the microscope. If "uninteresting," more sections were cut until the surface of the block indicated a change. Other sections were then stained and examined. If any question arose as to the exact relation between the misplaced müllerian mucosa and that of the tubal stump, complete serial sections were saved and stained until this point was determined. In all cases the entire block or the portion of it showing ectopic müllerian mucosa was cut and all sections were saved until the specimen had been studied. In addition, sections taken at intervals which showed the important features of the specimen were mounted, numbered according to their sequence and

kept. This feature of the work was entrusted to Miss Isabel Peck, who is well trained in laboratory technic and in the histologic diagnosis of müllerian tissue. Without her interest and cooperation this study would not have been accomplished.

THE RESULTS OF THE CULTIVATION OF MÜLLERIAN MUCOSA IN WOMEN AS  
SHOWN BY THE HISTOLOGIC STUDY OF TUBAL STUMPS FOLLOWING  
SALPINGECTOMY AND TUBAL STERILIZATION

We have already shown the immediate results of salpingectomy and tubal sterilization. On severing the tube its walls retract and its mucosa protrudes. The tubal mucosa may also be traumatized by clamping, ligating the tube and transfixing it by a ligature. Bits of tubal mucosa, at times, are transplanted in and about the tubal stump and even in more remote portions of the field of operation. The study of

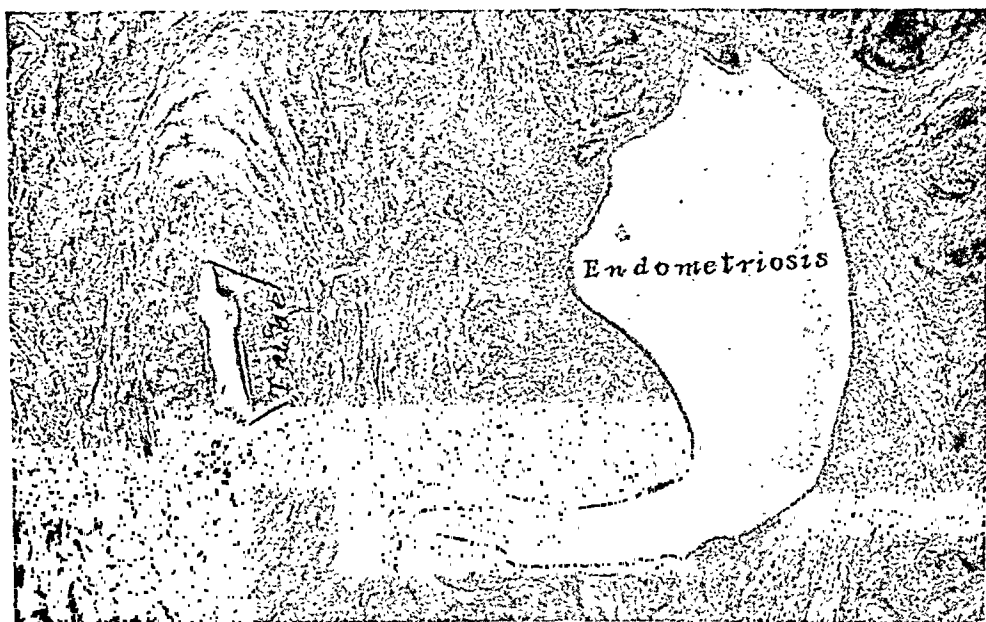


Fig. 5.—Photomicrograph (x 25) of a portion of the uterine cornu, containing a tubal stump, tube and ovary removed nineteen years before the last operation. A wedge-shaped piece of the uterine cornu was described as having been removed with the tube at the first operation. The tube is shown in cross-section (very close to the end of the stump) with an endometriosis lateral to it. It was definitely determined that this misplaced "endometrial" tissue did not arise from the tubal mucosa by direct extension or sprouts. Circumstantial evidence indicates that it is a seedling, possible from bits of tubal mucosa transplanted at the first operation.

tubal stumps and adjacent or adherent structures, removed at a subsequent operation, should show the results of the unintentional cultivation of tubal mucosa initiated at the first operation.

Since September, 1926, we have been collecting and studying tubal stumps. A few were obtained from specimens removed prior to that date. Two were from autopsies (courtesy of Dr. V. C. Jacobson) and the remaining were removed since September, 1926. Tubal stumps, often with structures adherent to them, were obtained from 36 patients. As bilateral salpingectomy or tubal sterilization had been done in 15 of these patients, 51 tubal stumps were available for histologic study.

An attempt was made to ascertain the occasion of the original operation, but in many instances this was only partially successful. In the majority of the cases one tube and ovary or both tubes and one ovary were reported to have been removed for salpingitis or its results. In 6 cases a ventrofixation of the uterus preceded by tubal sterilization had been done. In 2 of these one tube and ovary had been removed. In 2 other patients an "ovarian cyst" had been removed. In 3 patients the first operation had apparently been for an endometrial hematoma of the ovary and its associated peritoneal endometriosis, though not so recognized by the operator. There was only 1 instance of tubal pregnancy in the series of original operations. The majority of the



FIG. 6.—Photomicrograph (x 10) of a longitudinal section, in a perpendicular plane, of the right uterine cornu, tube and ovary removed eleven years before for a fibroma of the ovary. Tubal sterilization was done on the opposite side and the uterus fixed to the abdominal wall. The tube was severed close to the uterus and its stump buried. The course of the interstitial portion of the tube is well shown and its lumen was followed (in other sections) to the end of the stump where sprouts (*sp*) of the tubal mucosa have invaded the tissues about the stump. A seedling (*sd*) is present mesial to the sprouts. It is of the same histologic structure as the latter, but was shown not to be continuous with them. Circumstantial evidence indicates that it might have grown from tubal epithelium transplanted at the first operation.

second operations were undertaken for the relief of pain caused by "adhesions." In 8 of these endometriosis apparently was the principal cause of the adhesions and discomfort, in 3 of which a peritoneal endometriosis was probably present at the first operation. Four patients were operated upon for uterine leiomyomata, 3 for tubal pregnancy, 3 for uncontrollable uterine bleeding and 1 for cancer of the uterine cervix.

An endometriosis was found in or about the tubal stumps in 30 of the 36 patients. As bilateral salpingectomy or tubal sterilization had been done in 15 instances, 51 stumps were studied. Endometriosis was found in 42 of these. Where 2 stumps were obtained from one patient, if endometriosis was found in one, it was also present in the other and furthermore there was a great similarity in the type of lesion in both stumps. The endometriosis usually resulted from sprouts growing out from the mucosa of the tubal stump (Figs. 6, 7, 8, and 9) but occasionally arose as seedlings springing up in situations where we know that bits of tubal mucosa might have been transplanted at the first operation. The evidence that many of these seed-



Fig. 7.—Photomicrograph ( $\times 10$ ) of a longitudinal section, in a horizontal plane, of the left uterine cornu, the seat of a previous sterilization (same case as the preceding). The interstitial portion of the tube is well shown with sprouts (*sp*) of the tubal mucosa in the uterine wall about the end of the stump and distal to these is a seedling (*sd*) with the same histologic structure as the sprouts but not continuous with the latter. If tubal epithelium transplanted a few millimeters from the end of the stump grows, it might grow if transplanted at a greater distance, and it also might grow if transplanted during other operations than salpingectomy and by other means than operations.

lings arose from this source was most convincing to me, but at best this evidence is only circumstantial. Positive proof of such an origin cannot be furnished. It may be claimed that the seedlings were present at the first operation or came from a differentiation of peritoneal mesothelium included in the operative wound or were originally sprouts, portions of which became "pinched off" by the reaction of the surrounding tissue. On the other hand, the evidence that the sprouts arose from pre-existing tubal mucosa and *not* from peritoneal

mesothelium was positive. The histologic structure of the seedlings and the sprouts was the same.

Seedlings without any evidence of sprouts were found in specimens from only three patients. Both seedlings and sprouts were found in specimens from four patients. I believe that this number should be much greater, as it is often very difficult and even impossible to exclude the presence of seedlings in specimens with an extensive endometriosis.

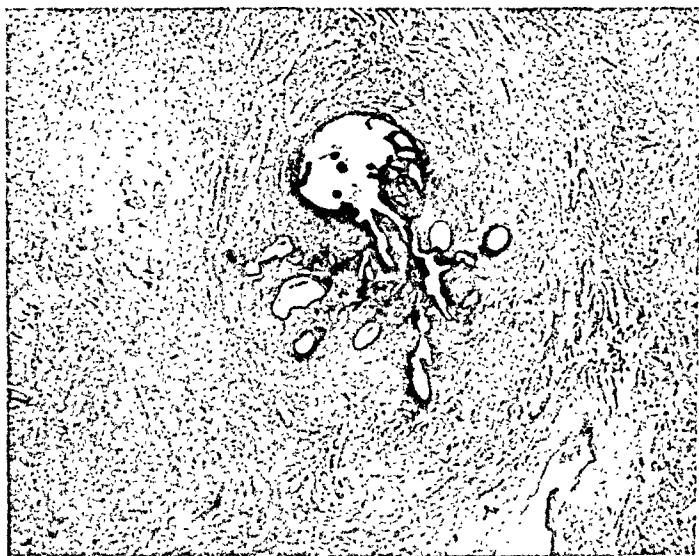


Fig. 8.—Photomicrograph (x 10) of a cross-section of a tubal stump at its distal end. The traumatized mucosa has become activated and has partially filled the lumen of the tube and as sprouts has invaded the tissues of the uterine cornu in which the stump had been buried at the first operation a year before. The distal extensions of the sprouts are shown in the next illustration.

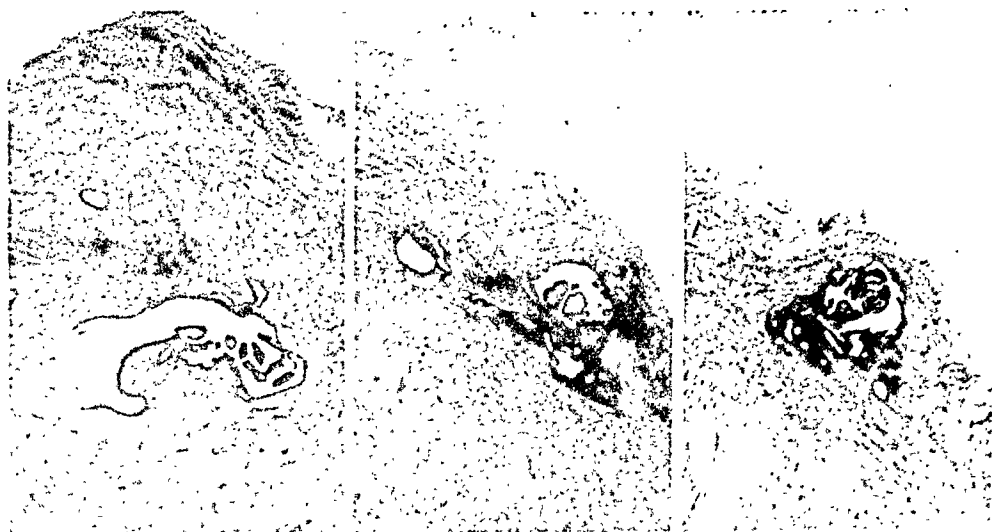


Fig. 9.—Three photomicrographs (x 10) from a series of cross-sections showing the distal extension of the endometriosis originating from the traumatized tubal mucosa of Fig. 8. It has extended almost to the peritoneal surface of the uterine cornu. Histologically it is of tubal type and resembles many of the lesions in peritoneal endometriosis of possible implantation origin.

Sprouts without demonstrable seedlings were present in and about the tubal stumps obtained from 23 patients.

Many interesting questions arise. Why does endometriosis not occur in all cases? Will it develop in women operated upon after the menopause? Will it occur if all ovarian tissue is removed at the first operation? Why is it insignificant in some and extensive in others?

In all cases the first operation was done before the menopause. In only two of the patients had both ovaries been removed. In the tubal stumps (four in number) from those two cases, no evidence of endometriosis was found. Endometriosis developed both in the patients operated upon for salpingitis and for tubal sterilization and apparently to the same degree. The condition present at the first operation apparently did not determine whether or not an endometriosis arose or its extent. The method of salpingectomy also seemed to have no influence



Fig. 10.—Three photomicrographs (x 10) from a series of cross-sections of a tubal stump which had been buried in the uterine cornu. The distal end of the stump appears in the third photomicrograph. Here histologically typical uterine mucosa, apparently arising from the traumatized and activated mucosa of the stump, has grown back, as a polyp, into the dilated lumen of the interstitial portion of the tube (see first two photomicrographs). This mucosa has invaded the uterine cornu beyond the stump. For a further extension of this invasion, see the next illustration. The dilated gland (*sd*) probably is a seedling. At a previous operation, two years before, the uterus was curetted, the pelvic floor repaired, both tubes and one ovary removed for salpingitis, and the uterus fixed to the abdominal wall. On severing the uterine end of the tubes, blood escaped from the uterine cavity through the lumen of the tubal stumps. Did the endometrial tissue in the distal end of the stump arise from the transplantation of a bit of uterine mucosa at the former operation or from a differentiation of the traumatized tubal mucosa? From a study of this and other specimens, I believe the latter.

upon the incidence or the extent of the endometriosis. It occurred both in patients in whom the tube had been removed and the stump ligated distal to the uterus and also in those in whom the tubal stump was buried in the uterine cornu.

When both tubes had been removed or incised and one or both ovaries retained, there was a great similarity in the endometriosis of both tubal stumps. This suggests that the tubal mucosa and its inherent ability to become invasive are usually the same in both tubes

of the same person, though often differing among individuals. This manifestation of a difference may not be peculiar to the individual, but may be due to other factors, possibly to the phase of the menstrual cycle in which the operation occurred.

In some instances the endometriosis was of tubal and in others of uterine type. The differentiation of tubal into uterine mucosa was one of the most interesting features of these lesions (Figs. 10, 11, 12, 13, and 14). We were unable to ascertain the factors which influenced its development. It followed salpingectomy for salpingitis and also for noninfected tubes. It occurred after tubal sterilization as well as salpingectomy and also in cases in which the tube had been removed distal to the uterus and its stump ligated as well as in salpingectomy with burial of the tubal stump in the uterine cornu. The



Fig. 11.—Photomicrograph (x 25) of a section of the uterine cornu from the series shown in the preceding illustration and distal to these. An endometrial cavity, arising from the direct extension of the endometrial tissue shown in Fig. 10 and partially filled with blood, is present. The blood evidently came from the mucosa lining this cavity as indicated by hemorrhage in its stroma. The patient was bleeding at the time of the operation. The mucosa of this ectopic endometrial cavity possibly was influenced to bleed by the same impulse as was the mucosa of the uterine cavity. The seedling (*sd*), shown in the preceding photomicrograph, also appears in this one.

possibility of the transplantation of uterine mucosa escaping from a preliminary curettage was considered in a few of the cases, but some of the patients had had no preliminary curettage. In the majority of cases the endometriosis, resulting from salpingectomy, was slight and only of scientific interest. In others, however, it was extensive and was responsible for the second operation. An endosalpingiosis or so-called adenomyoma evidently was present in the tubes at the first operation in two patients and might have been present in others. The second operation in each of these cases was for tubal pregnancy. Endometriosis (endosalpingiosis) was found in the interstitial portion of the tube on the side of the tubal pregnancy and also in the tubal

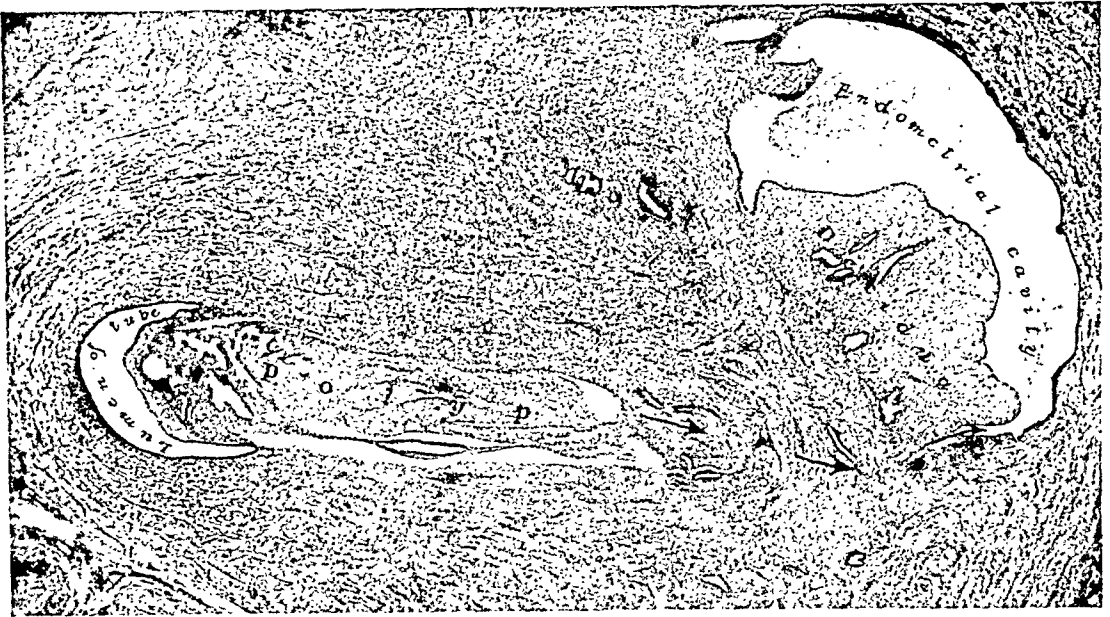


Fig. 12.—Photomicrograph (x 10) of a longitudinal section, in a horizontal plane, of a uterine cornu with a buried tubal stump. It shows the same sprouting of the traumatized mucosa of the distal end of the stump as that indicated in Figs. 10 and 11. Like the latter it has grown back into the lumen of the stump as a polyp and has invaded (see arrows) the uterine cornu distal to the stump forming ectopic endometrial cavities lined by uterine mucosa with a definite decidual reaction. The first operation, ten years before, had been a ventrofixation with an attempted tubal sterilization. An ectopic pregnancy was present in the opposite uterine cornu, possibly situated in one of the ectopic endometrial cavities resulting from the extension of the traumatized tubal mucosa. A decidual reaction was found in the mucosa of the uterine cavity, in that of the ectopic endometrial cavities of both uterine cornua but not in the mucosa of the tubes proper.

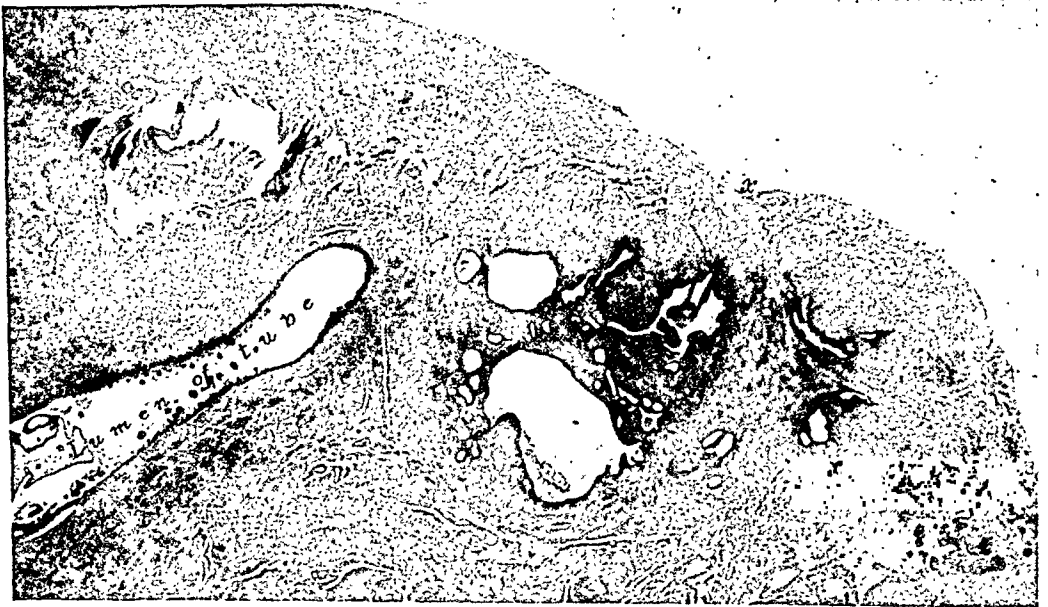


Fig. 13.—Photomicrograph (x 10) of a longitudinal section, in a perpendicular plane, of a tubal stump ligated distal to the uterine cornu in a right salpingo-oophorectomy four years before. It would seem that the tube had been ligated at  $\alpha$ . The dilated lumen of the interstitial portion of the tube is well shown. An endometriosis of the tubal stump is present back of and also distal to the apparent site of ligation. Both may have been initiated by the trauma of the ligature, or tubal endometriosis might have been present at the time of the first operation. Clamping the tubal stump at the first operation also might have contributed to the endometriosis of this section.



stump of the opposite side (tube removed at previous operation) in each case. In both situations the histologic structures of the two lesions were similar.

Trauma, other than operative, may be a factor in the etiology of tubal endometriosis as indicated by an endometriosis of the tubal stump found in a patient with spontaneous amputation of the right tube and ovary.

#### ENDOMETRIOSIS OF THE OVARY FOLLOWING SALPINGECTOMY

In 1926 Dougal<sup>9</sup> described a case of endometriosis of the ovary after removal of both tubes and the opposite ovary for gonorrheal salpingo-

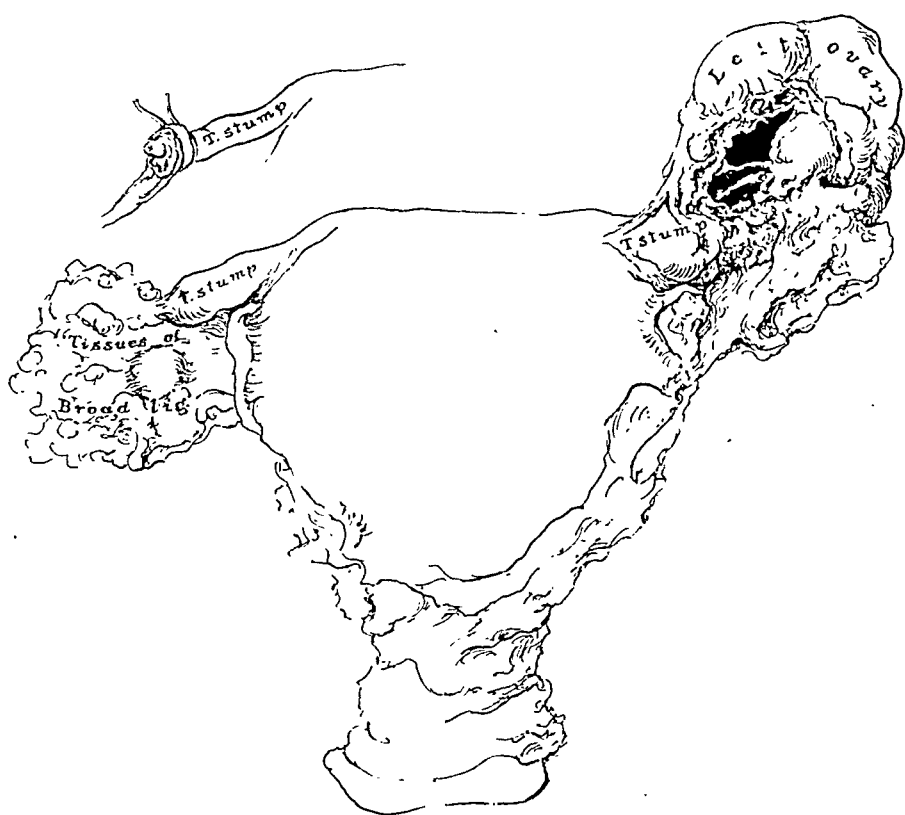


Fig. 14.—Anterior view (x 2/3) of the uterus, both tubal stumps, and the left ovary, Case 1. The right tubal stump, ligated distal to the uterus, is adherent to the indurated mesosalpinx and broad ligament (Fig. 15). The left tubal stump is adherent to the mesial surface of the ovary. The latter contains an endometrial cyst or hematoma. See Figs. 16 and 17.

oöphoritis eleven and a half years before. A typical adenomyoma was present in both uterine cornua and the ovary was adherent to the posterior surface of the uterus near the left cornu. He offered three possible explanations for the origin of the endometrial tissue in the ovary after the removal of both fallopian tubes:

1. The endometrial tissue may have been in the ovary before the tubes were removed.
2. One or either stump of the tubes may have been left patent after the operation, and so allowed fragments of endometrium to escape into the peritoneum during menstruation.
3. The endometrium may extend directly from the uterine cavity to the ovary through intervening structures by infiltration.

He believes that the latter is the correct one in his case for the following reasons: An adenomyoma in both uterine cornua strongly suggests that the uterus was primarily responsible for the growth in the ovary. The presence of islands of endometrium, dotted about through the tissues intervening between the uterine cavity and the



Fig. 15.—Photomicrograph (x 10) of a longitudinal section of the right tubal stump of Fig. 14. The stump apparently had been ligated distal to the uterine cornu at *x*. The lumen of the tube was traced (in other sections) almost to the end of the stump, where it is partially restored by the repair following the trauma of the ligation. An endometriosis "End" evidently arising from the traumatized tubal mucosa, back of the ligature, has invaded not only the end of the stump but also the tissues of the mesosalpinx and broad ligament beneath it. The endometriosis of the structures beneath the stump and directly continuous with that of the latter has become activated to form typical uterine mucosa without any evidence of a reaction to menstruation. Endometriosis, such as this, might invade any organ or structure adherent to the stump.

adherent ovarian cyst would appear to indicate that the extension had been by infiltration from the mucosa of the uterine cavity to the ovary.

I have encountered 4 cases of endometriosis of the ovary in patients who had had a previous salpingectomy.

CASE 1.—Endometriosis of the left ovary and of both tubal stumps after left salpingectomy and right salpingo-oöphorectomy. Patient, aged thirty-four, had one child, aged thirteen and a miscarriage two years later. The appendix was removed in the year 1909 and in 1919 both tubes, the right ovary and part of the left ovary were removed for bilateral salpingitis. The uterus was suspended. The tubes were described as being closed at the last operation and no evidence of ovarian hematomas or endometrial tissue in the pelvis was observed.

The present complaint was severe menstrual pain and also pain independent of menstruation. Pelvic examination showed the uterus to be in normal position, its movements restricted and a nodular induration in the culdesac. A preoperative diagnosis of endometriosis was made. The third operation at the Albany Hospital, May 2, 1927, showed the uterus to be in normal position. The stump of the right tube was fused with the indurated tissues of the broad ligament beneath it. The stump of the left tube was adherent to the mesial surface of the ovary. A slight amount of endometriosis was present in the posterior culdesac. The uterus with the portion of the broad ligament adherent to the right tubal stump was



Fig. 16.—Photomicrograph (x 25) of a portion of a cross-section of the left tubal stump (Fig. 14). The lumen of the distal end of the stump is shown. The mucosa has become activated partially filling the lumen of the tube and also invading the wall of the stump, thus forming an endometriosis in this situation. For a further extension of this endometriosis, see the next illustration.

carefully removed, together with the left ovary (Fig. 14). In freeing the latter the walls of an ovarian hematoma were torn, as usually occurs in removing adherent endometrial hematomas of the ovary.

An endometriosis was present in the right tubal stump evidently arising from the growth of tubal mucosa injured by ligating the stump (Fig. 15). This had extended through the wall of the stump and had invaded the underlying tissues of the broad ligament. A similar sprouting of the mucosa of the left tubal stump was found (Fig. 16) which had invaded the structures adherent to it, including the left ovary. It was also demonstrated that the müllerian mucosa, lining the portion of the hematoma of the left ovary adherent to the tubal stump, was directly continuous with the mucosa of the tube through the invasion just described (Fig. 17).

It is impossible to state whether the endometriosis in the culdesac arose from the previous operation or was present at that time. It may be claimed that

endometrial tissue was present in the ovaries at the first operation and endometriosis of the tubal stumps arose from this. However, the indications that the müllerian mucosa in the left ovary arose from the direct extension of the traumatized mucosa of the tubal stump are as follows:

1. It was shown to be continuous with it (Fig. 17).
2. The müllerian mucosa in the ovary had invaded that organ from its mesial surface, the surface adherent to the tubal stump. Endometrial tissue in the ovaries of patients who have not had a previous operation nearly always occurs on the lateral and under surfaces of that organ.
3. A similar endometriosis was present in the opposite tubal stump (ovary removed) with invasion of the adherent structures (Fig. 15).

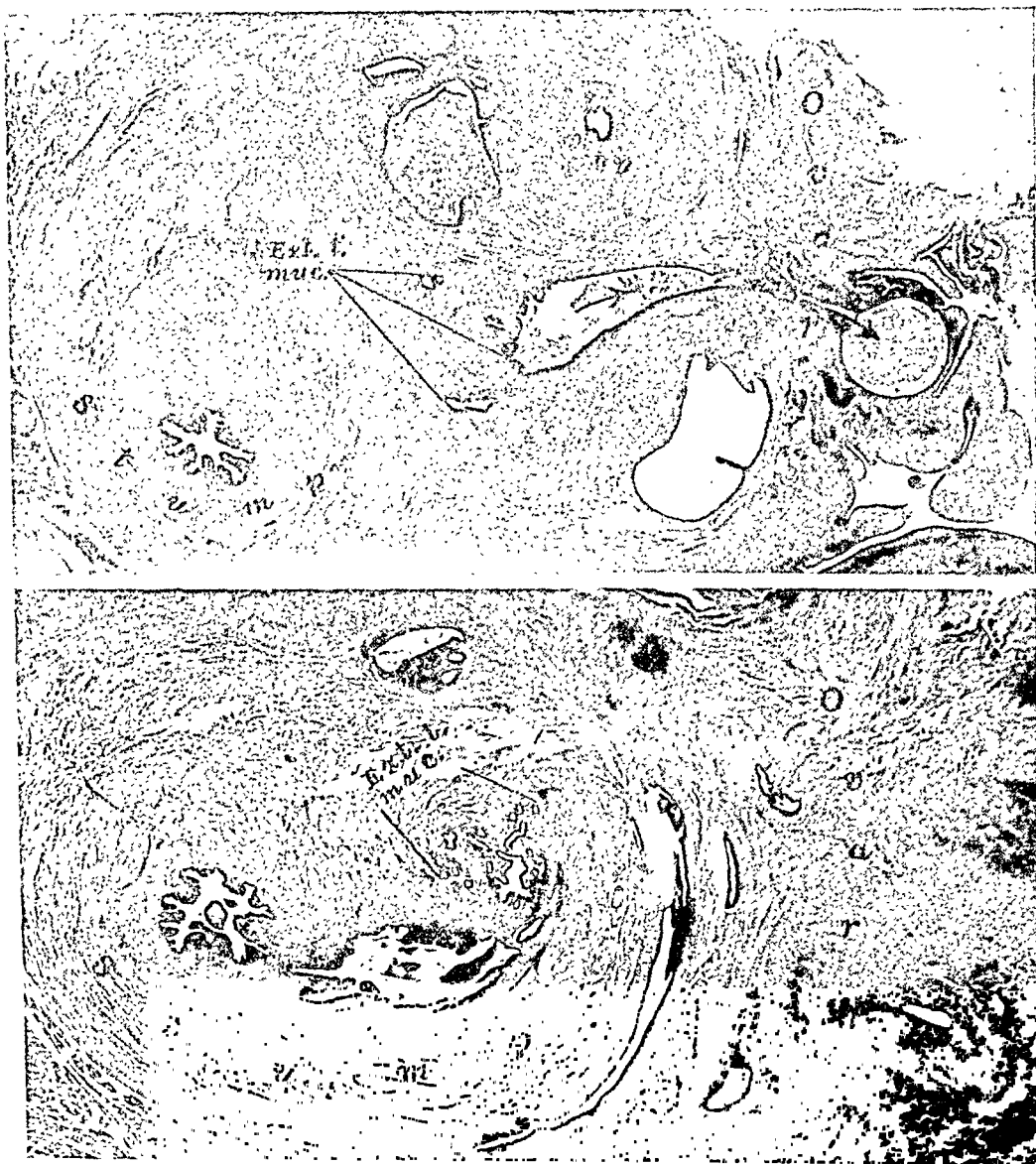


Fig. 17.—Two photomicrographs (x 10) of cross-sections of the left tubal stump and portions of the ovary adherent to it. The lower photomicrograph shows a continuation of the endometriosis (Ext. t. muc.) which arose from the direct invasion of the stump by its mucosa. (See Fig. 16.)

The upper photomicrograph demonstrates a further extension of this endometriosis and that the latter is continuous with the endometrial lining of the portion of the ovarian cyst adherent to the stump. This indicates that the endometrial lining of the cyst might have arisen from the direct extension of the traumatized mucosa of the tubal stump into the adherent ovary (ovary had been resected).



Fig. 18.—Posterior view ( $\times \frac{2}{3}$ ) of the uterus and right tubal stump and ovary, (Case 2). The stump of the right tube is adherent to the mesial surface of the right ovary. See the next illustration.

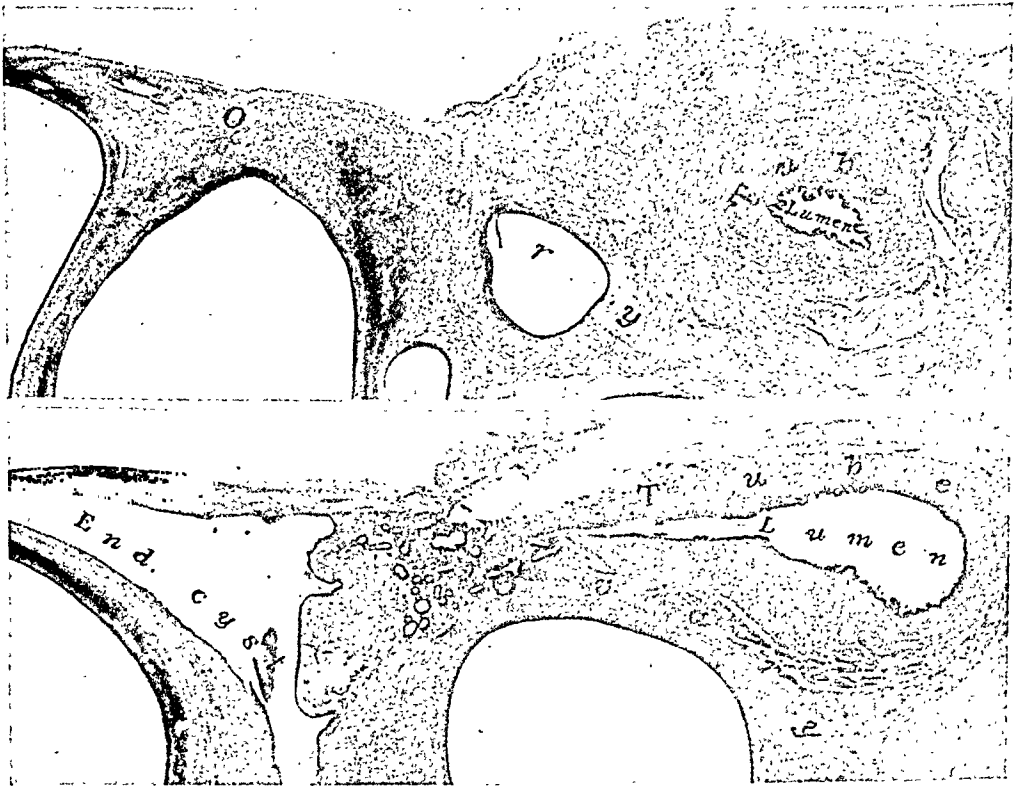


Fig. 19.—Two photomicrographs ( $\times 10$ ) from a series of sections demonstrating the relation of the tube to the ovary of Fig. 18.

The upper photomicrograph, of a cross-section of the stump near its base, shows a normal appearing tube adherent to the ovary. As these sections were followed toward the tip of the stump, a small endometrial cyst of the ovary appeared lateral to the stump.

The lower photomicrograph shows the origin of the endometrial lining of the cyst from tubal mucosa by direct extension through the wall of the tube traumatized at the first operation.

CASE 2.—Endometriosis of the right ovary, directly continuous with the mucosa of the tubal stump, following right salpingectomy. Patient, aged thirty-four, married twice but never pregnant, complained of severe pain in the right lower abdomen. Menstruation was painless. The patient had had a conservative operation in 1924 for bilateral salpingitis, being very anxious to have children. The operative procedures at the first were as follows: appendicectomy, resection of half of the right ovary, right salpingectomy and removal of the distal end of the left tube. At the second operation, May 12, 1927 at the Albany Hospital, the uterus was found to be retroflexed and adherent; the stump of the right tube was adherent to the mesial surface of the right ovary; the left ovary appeared normal and the shortened left tube was occluded, but free from adhesions. The uterus, right tube, and ovary were removed (Fig. 18).

The histologic study of the right ovary with adherent tubal stump showed a small endometrial hematoma of the ovary, the mucosa of which was continuous with



Fig. 20.—Photomicrograph (x 8) of a longitudinal section of the right uterine cornu (Case 3). Right tube and ovary and left tube had been removed. The specimen was obtained, at autopsy, from a patient dying of diphtheria. An endometriosis is present, evidently arising from the direct extension of the tubal mucosa.

the mucosa of the tubal stump by direct extension (Fig. 19). The indications that the endometrial tissue in the ovary was derived from the mucosa of the tube are as follows:

1. It was shown to be continuous with it.
2. It was present near the mesial and not the lateral or under surface of the ovary as occurs in endometriosis of the ovary of nonoperative origin.
3. It was the only endometriosis found in the specimen.

CASE 3.—Endometriosis of the left ovary and both tubal stumps following left salpingectomy and right salpingo-oöphorectomy. The patient, aged thirty-two, was admitted to the contagious department of the Albany Hospital in a dying condition from diphtheria. She lived only a few hours. A postmortem examination was obtained and through the courtesy of Dr. V. C. Jacobson, I had an opportunity to study the pelvic organs. The right tube and ovary and the left tube had been removed. The date of the operation was not obtained. An endometriosis was

present in the right uterine cornu and surrounding tissue from a direct infiltration by the mucosa of the interstitial portion of the tube (Fig. 20). A similar condition was also present in the left uterine cornu. In addition the mucosa of the tubal stump, distal to the uterine cornu, had invaded the tissues adherent to it including the left ovary (Fig. 21). Three small endometrial hematomas were present in the left ovary. The müllerian lining of these was found to be continuous with the "streams" of tubal mucosa arising from the mucosa of the tubal stump and invading the structures adherent to it (Fig. 22). The indications that the endometrial tissue in the ovary (Fig. 23) was derived from the mucosa of the tube are as follows:

1. Three small endometrial hematomas were present in the ovary and all were shown to be continuous with tubal mucosa which had escaped from the tubal stump by direct extension.

2. The hematomas were of the same size and, therefore, apparently of the same age.

3. These hematomas were situated near the mesial surface of the ovary.



Fig. 21.—Two photomicrographs (x 25) from a series of cross-sections of the left tubal stump and adherent tissues distal to the uterine cornu, possibly where the stump had been ligated. The tube apparently has been traumatized (theory) and its mucosa has grown out from the tube and invaded the surrounding structures.

4. An endometriosis was also present in the tissues about the opposite tubal stump, the ovary having been removed.

5. Endometriosis was found only about the tubal stumps, including the adherent left ovary.

CASE 4.—Endometriosis of the right ovary and both tubal stumps after right salpingectomy and left salpingo-oöphorectomy. Patient, aged thirty-five, had one child, aged sixteen years and two miscarriages, the last one twelve years ago. Nine years ago the appendix, left tube and ovary, and the right tube had been removed for bilateral pyosalpinx. The present complaints were profuse menstruation, bleeding independent of menstruation, leucorrhea, dysmenorrhea, and a sense of a lack of support. Pelvic examination showed a weakened pelvic floor, hypertrophied cervix with eversion of the cervical mucosa, and the uterus in descensus. The second operation was at the Albany Hospital December 3, 1927. The right ovary was adherent to the tubal stump of that side. The portion of the ovary adherent to the stump was resected and removed with the entire uterus. (Fig. 24). The pelvic floor was repaired. An endometriosis was present in the left tubal stump from the direct extension or sprouting of the mucosa of the

end of the stump. An endometriosis was also present in the tissues of the mesosalpinx distal to the stump and apparently arising as seedlings from transplanted tubal mucosa. Their continuity with the sprouts in the stump was not established (Fig. 25). A similar sprouting of the mucosa of the end of the right tubal stump was present. Small patches of müllerian mucosa of a structure identical with that of the sprouts from the tubal mucosa were present in the stump (Fig. 26), in the adhesions (Fig. 27), between the tubal stump and the ovary, and in the portion of the ovary adherent to the stump. Hematomas were present in some

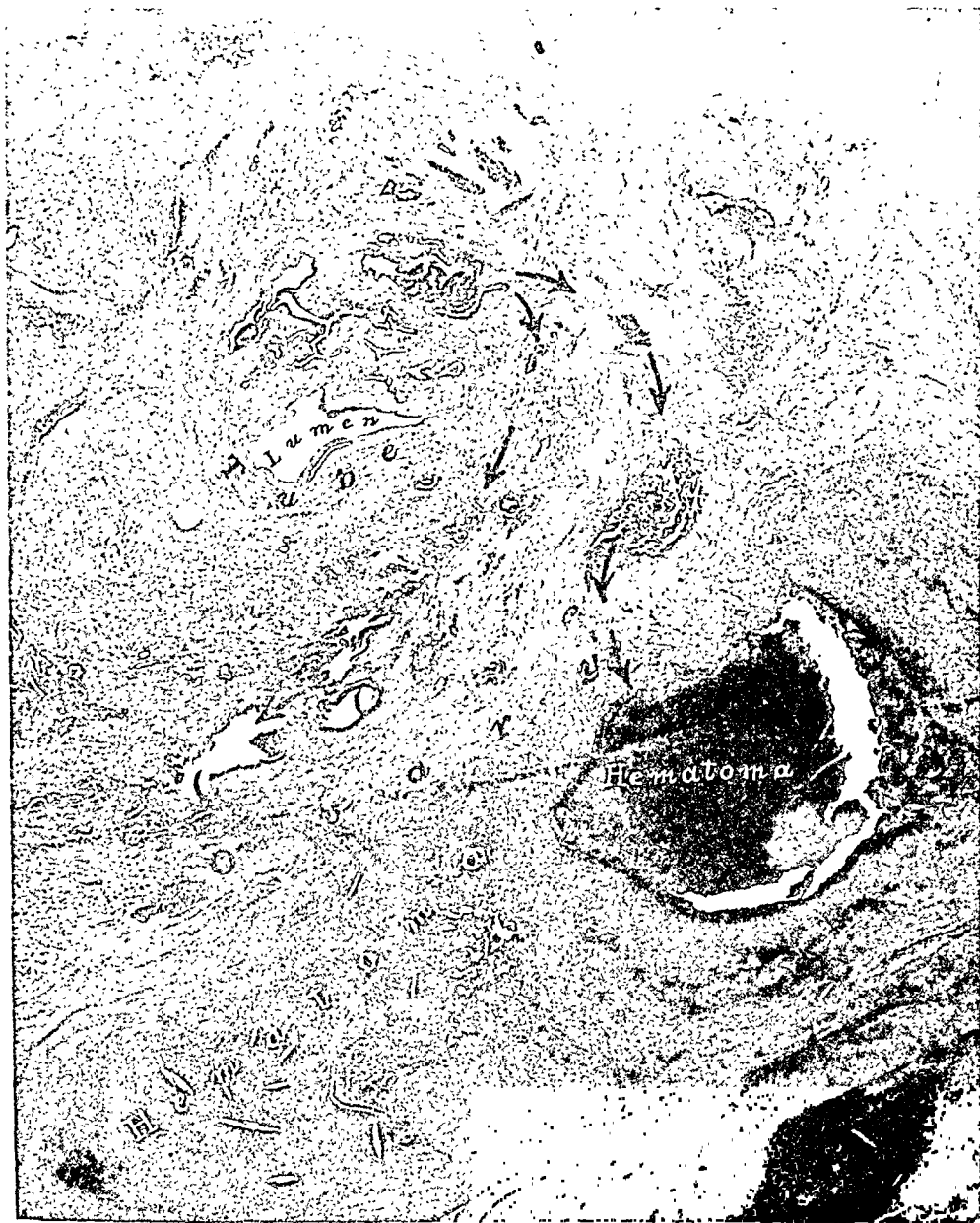


Fig. 22.—Photomicrograph (x 10) of a cross-section of the left tubal stump and adherent structures, including the ovary, distal to the sections shown in the preceding illustration and therefore, distal to the site of apparent ligation of the stump (from the same series of sections as the preceding). The dilated lumen of the stump is well shown with an endometriosis in its walls and streams of tubal mucosa invading the surrounding structures. The preceding illustrations indicated that these streams of mucosa arose from the mucosa of the tubal stump. Two endometrial hematomas or cysts are shown in the adherent ovary. The streams of tubal mucosa, just described, were found to empty into these hematomas. See arrows.



of these foci in the ovary. These patches of müllerian-like tissue, just described, appeared to be seedlings and were not continuous with the sprouts from the mucosa of the stump. The indications that the "müllerian" mucosa in the ovary arose from tubal epithelium transplanted at the first operation are as follows:

1. The study of the immediate results of salpingectomy show that tubal epithelium, at times, is transplanted by the surgeon.
2. The seedlings in this case were found where such "seeds" might easily have been sown.
3. They were present in the tubal stump itself, in the adhesions between it and the ovary and in the portion of the ovary adherent to the stump.
4. The histologic structure was identical with that of the sprouts arising from the tubal mucosa.
5. They were not continuous with the mucosal sprouts.
6. They were present on the mesial surface of the ovary.
7. Similar seedlings were found in the tissues about the opposite tubal stump, on which side the ovary had been removed.

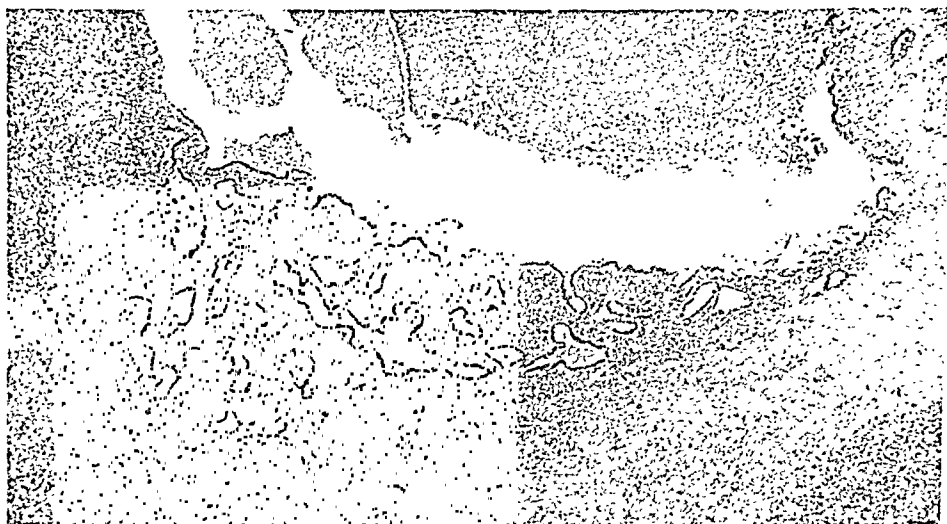


Fig. 23.—Photomicrograph ( $\times 25$ ) of a portion of the endometrial lining of one of the hematomas shown in the preceding illustration. The evidence that these ovarian hematomas arose from tubal mucosa by direct extension is as follows: The mucosa of the tubal stump was shown to have extended beyond the stump, thus invading the surrounding structures. These streams of tubal mucosa could be traced to, i.e., emptied into the ovarian hematomas. The hematomas are nearly of the same size and, therefore, possibly of the same age. They are situated near the mesial and not the lateral or under surfaces of the ovary where endometrial hematomas of non-operative origin usually arise. A similar endometriosis of tubal origin was present about the opposite tubal stump on which side both the tube and the ovary had been removed.

#### ENDOMETRIOSIS OF THE ABDOMINAL SCAR FOLLOWING SALPINGECTOMY AND TUBAL STERILIZATION

Several cases of endometriosis of the abdominal scar after salpingectomy have been reported. Nicholson collected 6 from the literature and 15 following ventrofixation of the uterus. As many operators perform tubal sterilization before fixing the uterus to the abdominal wall, the lumen of the tube might have been incised in some of the reported cases of ventrofixation. It is possible in all cases of salpingectomy and tubal sterilization that müllerian epithelium may be

transplanted to the abdominal wound. This has been recognized by others who have reported cases of endometriosis of laparotomy scars. Nicholson states that the anatomic continuity between the epithelium of the uterine mucosa and that of the tumors of the abdominal wall was not established in a single instance in the cases collected by him.

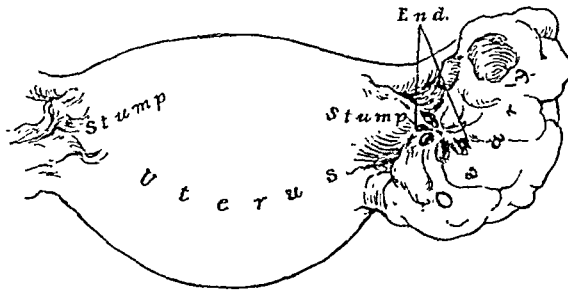


Fig. 24.—Fundus of the uterus and the adherent right ovary (natural size). The left tube and ovary and the right tube had been removed nine years before for salpingitis (Case 4). The ovary is adherent by its mesial surface to the right uterine cornu with the gross evidence of an endometriosis of the portion of the ovary adherent to the tubal stump. See also Figs. 25, 26, and 27.

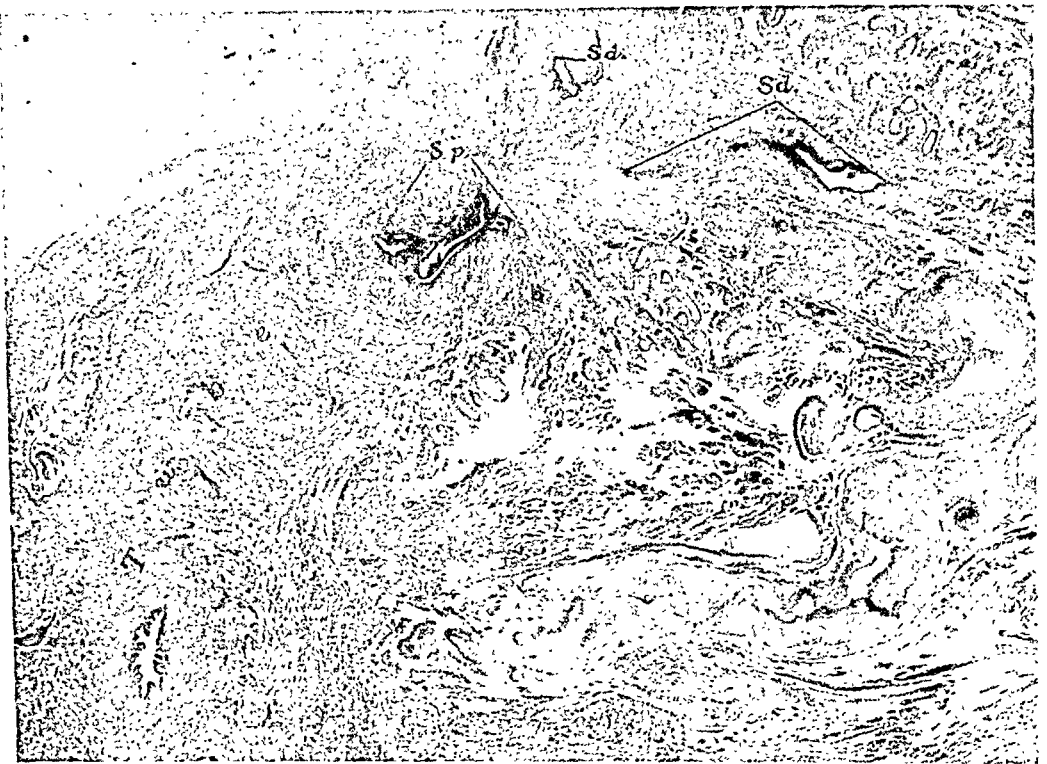


Fig. 25.—Photomicrograph (x 10) of a longitudinal section, in a perpendicular plane, of the left uterine cornu including the tubal stump. The stump had apparently been ligated at  $x$ . The walls of the tube can easily be seen and in one place its lumen. The lumen was followed (other sections) to the end of the stump where sprouting (sp) is present. Seedlings (sd) are present in the tissues distal to and adherent to the stump. These seedlings have the same histologic structure as the sprouts and are not continuous with them. The evidence indicates that these seedlings arose from tubal mucosa "tied off" or otherwise transplanted at the first operation.

I have encountered only 2 instances of endometriosis of the abdominal wall following ventrofixation with tubal sterilization (in one case one tube and ovary had been removed).

CASE 5.—Endometriosis of both uterine cornua and the left rectus muscle following ventrofixation of the uterus. Patient, aged thirty (three children) had been operated on by me in September, 1921, for prolapse of the uterus. The cervix was amputated, the pelvic floor repaired and after severing and ligating both tubes, the fundus of the uterus was fastened, extraperitoneally, to the ab-



Fig. 26.—Photomicrograph (x 25) of the tip of the right tubal stump. A sprouting (*sp*) of the tubal mucosa is shown and also seedlings (*sd*) in the wall of the uterine cornu which have the same histologic structure as the sprouts.

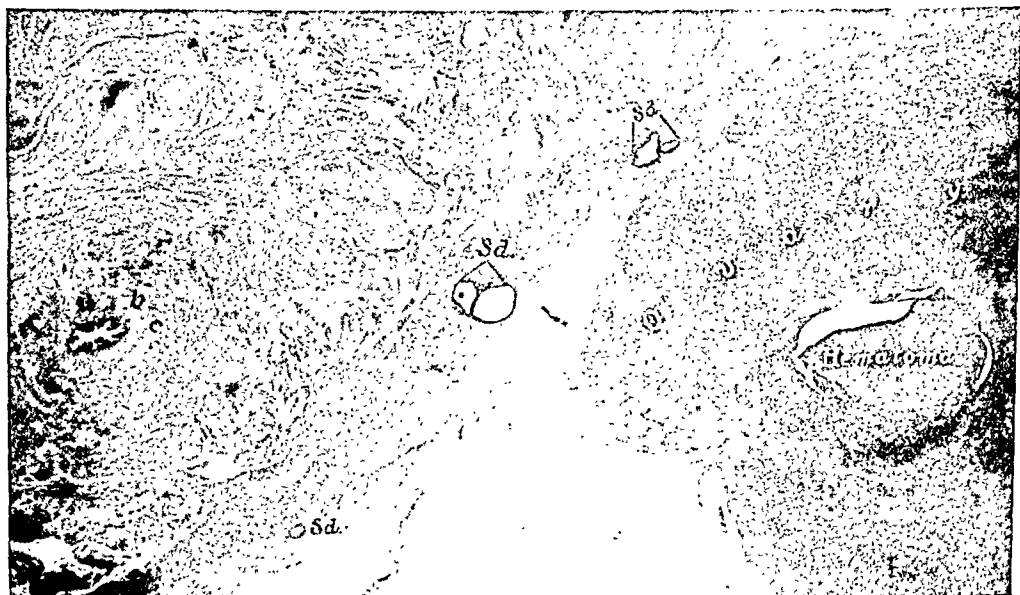


Fig. 27.—Photomicrograph (x 10) of the right tubal stump, adhesions between it and the ovary and a portion of the ovary. Seedlings with the same histologic structure as the sprouts and the seedlings shown in Figs. 25 and 26 are present in the adhesions. The lining of the ovarian hematoma has the same histologic structure as these. Evidence, just presented, indicates that the hematoma of the ovary is a seedling derived from the transplantation of tubal epithelium, but, at best, this evidence is only circumstantial.

dominal wall. The uterus was not curetted. The patient felt well for a year after the operation, when, during menstruation, she began to have pain and tenderness in the abdominal wall to the left of the scar. This increased in severity and duration. A nodule was first noticed by her three years after the operation.

This nodule seemed larger during menstruation and was very tender at that time. She was examined by me in September, 1926. The uterus was found to be fixed to the anterior abdominal wall and a definite tender nodule was felt in the left rectus muscle and apparently attached to the uterus. A preoperative diagnosis of endometriosis of the abdominal wall was made. The uterus and left tube and ovary were removed with the nodule attached to the left uterine cornu (Figs. 28 and 36). The nodule involved the left rectus muscle and was fused with the left uterine cornu at the site of the tubal sterilization (Fig. 37). The entire specimen was fixed in formalin and the course of the tubal stump and possible origin of the ectopic müllerian tissue was studied by sections cut in planes parallel to the long axis of the uterus. An endometriosis of the uterine cornu was found and also of the peritoneum, which had been sutured about the fundus of the uterus

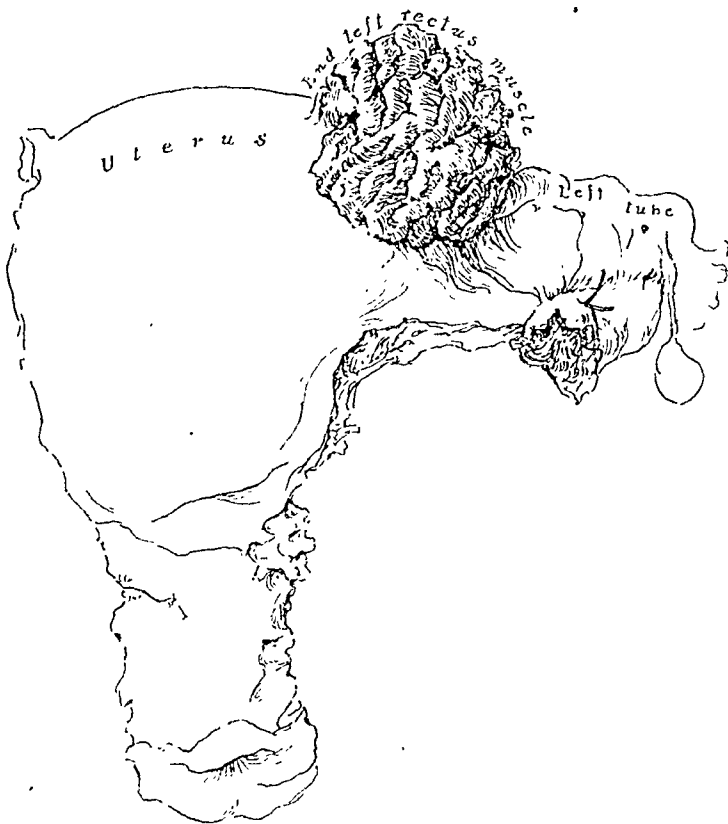


Fig. 28.—Anterior view ( $\times 2/3$ ) of the uterus, left tube and ovary with a piece of the left rectus muscle which is fused to the surface of the left uterine cornu at the site of a previous tubal sterilization (Case 5). See Figs. 29, 35, and 36.

at the first operation. The endometrial elements had invaded the rectus muscle causing the nodule which could be felt in the abdominal wall. By carefully following the course of the tube beginning at its origin from the uterine cavity, it was found that an endometriosis of the uterine cornu had resulted from a direct extension of the traumatized tubal mucosa in the end of the severed tube (Fig. 29). The endometriosis of the uterine cornu was found to be continuous with that of the peritoneum adherent to it and also with that in the rectus muscle. It was impossible to follow the course of all of the endometrial elements in the specimen and, therefore, one cannot state that all of the endometrial tissue of the abdominal wall arose from a direct extension of the mucosa of the tubal stump, but some of them did. Grossly, an endometriosis also was present in the opposite uterine cornu, but microscopic sections were not studied, as unfortunately the specimen was lost.



CASE 6.—Endometriosis of both uterine cornua and of the left rectus muscle, following ventrofixation of the uterus. Patient, aged forty-two (two children) had been operated on by me in 1923 for a weakened pelvic floor and retroverted uterus. The uterus was curetted, cervix amputated, pelvic floor repaired, appendix, left tube and ovary (cystic) removed, right tube severed at its uterine end and ligated and the fundus of the uterus fastened, extraperitoneally, to the anterior abdominal wall. Small endometrial implants were present in the culdesac. The patient felt well for over two years when she began to have pains during menstruation in the abdominal wall to the left of the scar. This gradually increased in severity and the tenderness persisted for two weeks after each menstrual flow. When examined by me in March, 1927, the uterus was found fixed to the abdominal wall and a definite tender nodule was felt in the left rectus muscle and apparently attached to the uterus. A preoperative diagnosis of endometriosis of the abdominal wall was made.

The uterus was removed with the nodule attached to the left uterine cornu (Fig. 30). The entire specimen was hardened in formalin. Sections of the

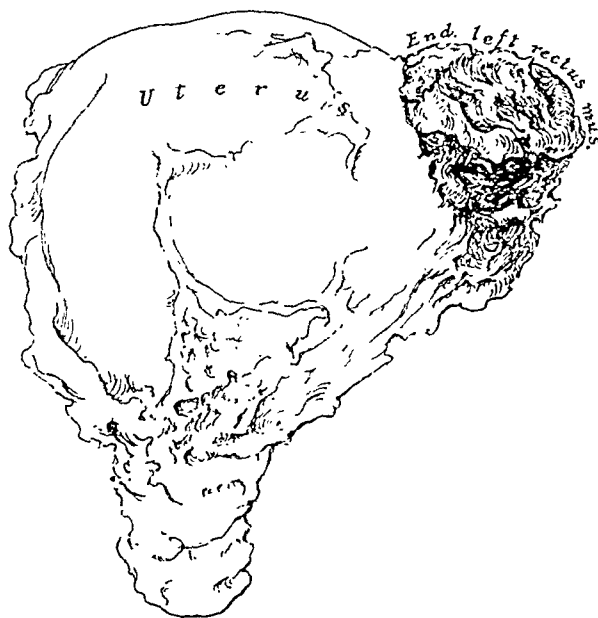


Fig. 30.—Anterior view (x 2/3) of the uterus with a nodule (End.) which is fused to the surface of the left uterine cornu at the site of a previous salpingectomy. This nodule was removed from the left rectus muscle (Case 6). See Figs. 32 and 33.

right uterine cornu with the nodule attached were cut in planes at right angles to the long axis of the uterus. An endometriosis was present in the right uterine cornu. By carefully following the course of the tubal stump, it was found that the endometriosis did not arise from a direct extension of the mucosa of the tubal stump, but some of it apparently arose from the mucosa of the severed tube which had been buried near the tubal stump (Fig. 31).

By carefully following the course of the left tubal stump, which had been buried in the uterine cornu after removing the tube, the direct extension of the tubal mucosa from the severed end of the tube into the tissues of the uterine cornu was found (Fig. 32 and 33). Endometrial tubules extended from this into the peritoneum which had been sutured about the fundus of the uterus and also into the left rectus muscle. As in the previous case, one cannot state that all of the misplaced endometrial tissue arose from the direct extension of the tubal mucosa, but some of it did. In these two cases the endometriosis of the abdominal wall arose from the pre-existing müllerian mucosa, namely, that of the traumatized tube and by direct extension.

CASE 7.—Endometriosis of the abdominal scar following salpingectomy for tubal pregnancy. In October, 1926, Dr. E. MacD. Stanton of Schenectady, sent me a specimen of endometriosis of the abdominal scar which he had removed, and included with it a history of the case and his operative findings. The patient had two previous operations, the first an appendicectomy twelve years before and the second an operation for tubal pregnancy five years later. A nodule appeared in the lower end of the abdominal scar three years after the last operation. This nodule became painful and swollen during menstruation and at the last two menstrual periods, blood was discharged from it. On examination a bleeding fistula with induration about it was found. At operation, by Dr. Stanton, the scar of the previous incision was incised above the mass and the peritoneal cavity opened. The uterus was not adherent to the abdominal wall, nor was there any



Fig. 31.—Photomicrograph (x 10) from a series of longitudinal sections, in a perpendicular plane, of the right uterine cornu, the seat of a previous tubal sterilization (Fig. 30). The very tip of the proximal tubal stump is shown in cross-section without any sprouts arising from its mucosa. The stump of the distal portion of the tube appears in longitudinal section with evidence that some of the endometriosis in this photomicrograph might have arisen from the direct outgrowth of its mucosa into the surrounding tissues.

demonstrable indication of peritoneal endometriosis. A typical endometriosis (Fig. 34 and 38) was present in the subcutaneous tissues of the laparotomy scar and was not connected with the peritoneal cavity. Its histologic structure was identical with that of the previous ones which arose from the tubal mucosa by direct extension. This, I believe, also arose from müllerian mucosa but by transplantation, just as similar lesions arise in the tissues about the tubal stump after salpingectomy.

#### THE REACTION OF POSTSALPINGECTOMY ENDOMETRIOSIS TO MENSTRUATION AND PREGNANCY

Postsalpingectomy endometriosis arises either from sprouts growing out from the mucosa of the tubal stump or as seedlings in and

about the tubal stump or at a distance from it. These seedlings have the same histologic structure as the sprouts, but are not continuous with them and occur in situations, where we know tubal epithelium easily may have been transplanted at the original operation. However convincing the evidence may be that some of these seedlings arise from the growth of transplanted tubal epithelium, this evidence, at best, is only circumstantial.

The direct endometriosis, that arising from an outgrowth of the mucosa of the tubal stump, is of two types: tubal and uterine. In those of tubal type the mucosa retains the structure of the tube from

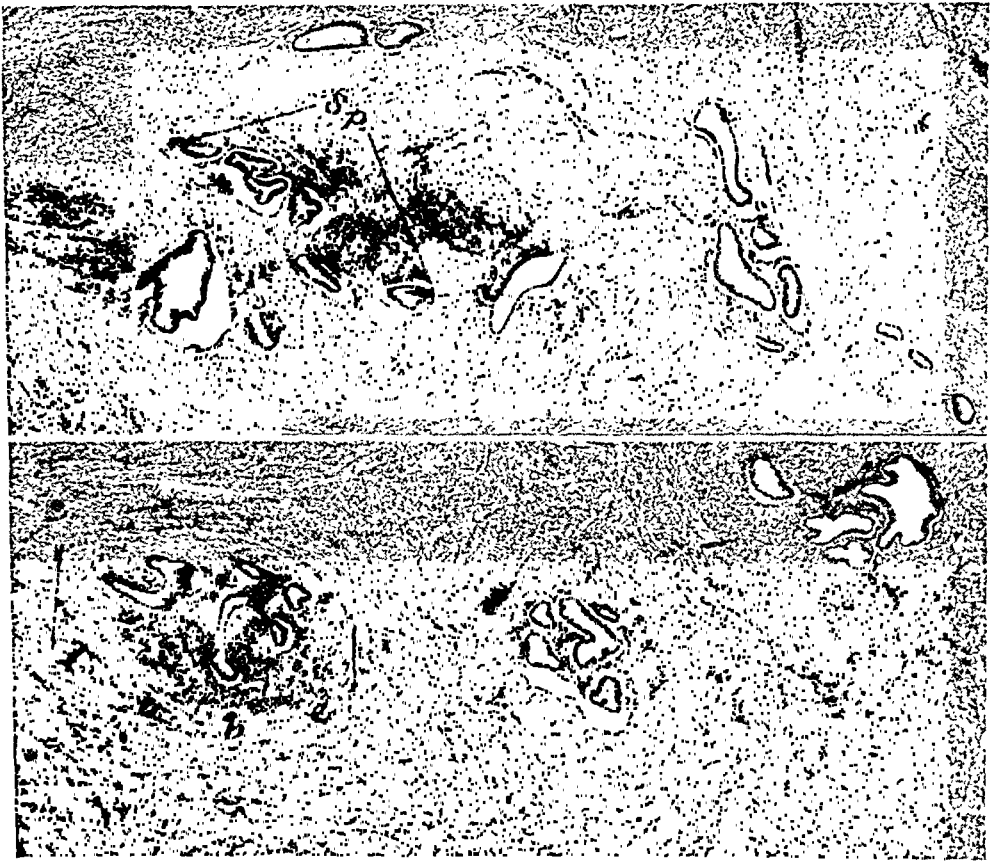


Fig. 32.—Two photomicrographs (x 25) from a series of longitudinal sections, in a horizontal plane, of the left uterine cornu which was fused with the nodule involving the left rectus muscle. Same case as the preceding. The left tube and ovary had been removed and the tubal stump buried in the uterine cornu.

The lower photomicrograph shows the distal end of the tubal stump with its lumen filled with hyperplastic (activated) tubal mucosa.

The upper photograph shows the mucosal sprouts which have grown out from the activated mucosa of the tubal stump and have invaded the tissues of the uterine cornu.

which it came. In those of uterine type the misplaced tubal mucosa is activated to simulate the structure of the uterine mucosa, even that arising from tubal stumps ligated distal to the uterine cornu. In some instances this postsalpingectomy endometriosis of uterine type does not react to menstruation, but in others it apparently does, as shown by evidence of hemorrhage in these misplaced uterine cavities of tubal origin. In the three cases with typical endometrial cysts



or hematomas in the ovaries arising from the direct invasion of that organ by tubal mucosa growing out from the tubal stump, the cysts were not only lined by endometrium-like tissue, but were also filled with blood. Some may claim that the blood in these ovarian hematomas was not of menstrual origin. In the two patients with endometrial "tumors" involving the recti muscles, these tumors arose from the direct extension or outgrowth of the mucosa of the tubal stump into the uterine cornu and thence to the anterior abdominal wall. These nodules not only contained misplaced "uterine" cavities lined by endometrium and filled with blood, but were very tender and seemed larger during menstruation.

Three of the patients with postsalpingectomy endometriosis were operated upon for tubal pregnancy. The first operation in two of

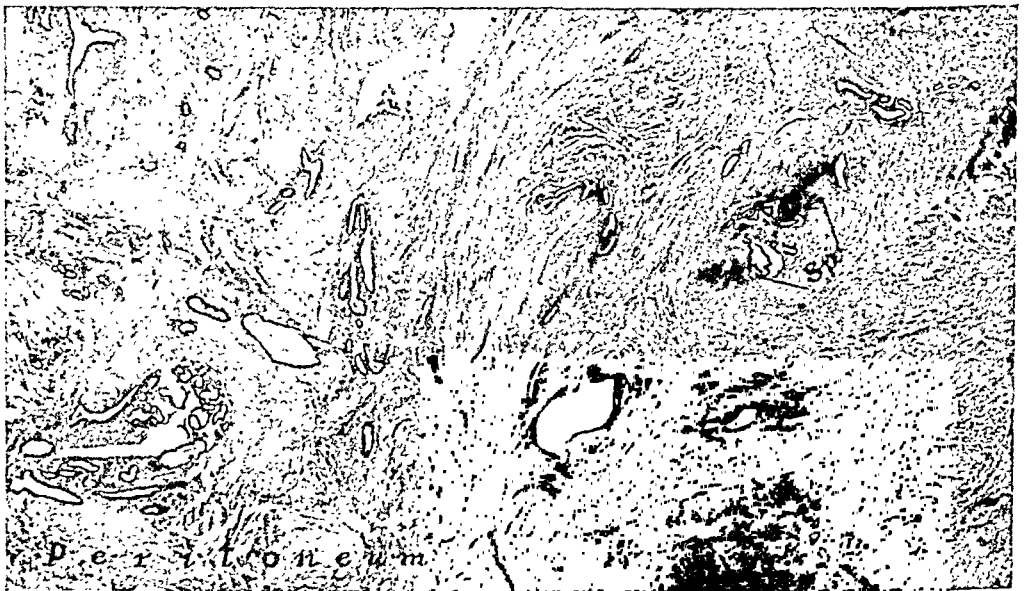


Fig. 33.—Photomicrograph (x 10) of the section shown in the upper photomicrograph of Fig. 32. A portion of the uterine cornu occupies the right half of the photomicrograph and the nodule which had involved the rectus muscle occupies the left half. The endometriosis of the uterine cornu which arose from the sprouting of the mucosa of the tubal stump can be followed by direct extension into the nodule fused with the uterine cornu. The endometriosis of the abdominal wall evidently arose from tubal mucosa by the direct extension of sprouts from the traumatized mucosa of the tubal stump.

these cases had been a unilateral salpingo-oöphorectomy for salpingitis and in the third patient a ventrofixation of the uterus with attempted tubal sterilization.

In the first two cases an endometriosis (of tubal origin) of both uterine cornua probably was present at the first operation. There was no evidence of a decidual reaction in this misplaced tubal mucosa of the uterine cornua, nor was it present in the mucosa of the uterine cavity in either case.

In the third patient an extensive endometriosis was present in both uterine cornua resulting from an outgrowth or sprouting of the

mucosa of the stumps of the severed tubes. It was impossible to ascertain the exact situation of the ectopic pregnancy, whether it was primarily tubal or primarily embedded in an ectopic uterine cavity in the lesion of the left uterine cornu. The endometriosis of tubal origin in both uterine cornua showed a marked decidual reaction (Fig. 12), as did also the mucosa of the uterine cavity. Sections of both tubes showed no decidual reaction in their mucosa.

We must conclude that postsalpingectomy endometriosis arising from the sprouting or outgrowth of the mucosa of the tubal stump, sometimes is activated to form histologically typical uterine mucosa and that this mucosa may not only menstruate, but during preg-

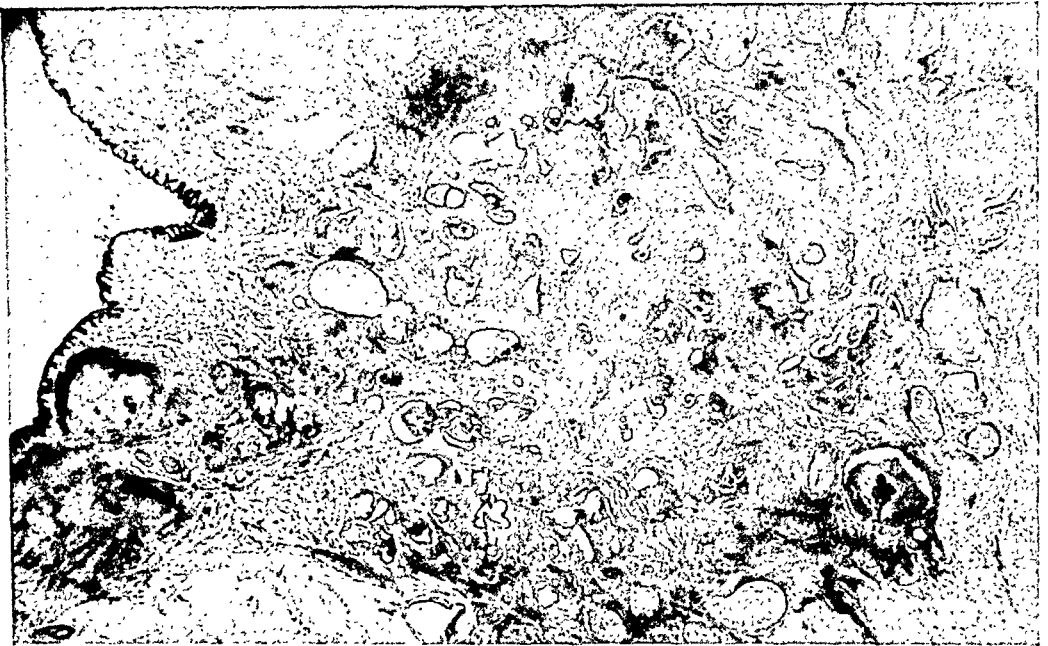


Fig. 34.—Photomicrograph (x 5) of a section of a subcutaneous endometriosis of the abdominal scar following salpingectomy (Case 7). The nodule is above the fascia of the abdominal wall. It is not connected with the peritoneum nor was the uterus adherent to the abdominal wall. It has the same histologic structure as that of the cases of endometriosis of the abdominal wall, just described. It was shown that the latter arose from tubal mucosa by direct extension. I believe that this also arose from tubal mucosa, but by transplantation.

nancy it may show a decidual reaction. We would expect that endometriosis arising from the transplantation of tubal mucosa might do the same.

#### THE CLINICAL SIGNIFICANCE OF POSTSALPINGECTOMY ENDOMETRIOSIS

These studies demonstrate that endometriosis frequently follows salpingectomy and tubal sterilization. They also show that it is usually of slight extent and only of scientific interest. On the other hand, in some instances, it is so situated and is sufficiently extensive as to cause discomfort and necessitate another operation for the relief of the patient. Many patients who have had conservative surgery for the relief of salpingitis and its sequelae have discomfort and pain following these operations which are usually attributed to

postoperative adhesions. In some of these cases the adhesions are the result of a postsalpingectomy endometriosis.

Postsalpingectomy endometriosis usually arises from sprouts growing out from the traumatized tubal mucosa, such as the mucosa protruding from the end of the severed tube, that resulting from clamping and ligating the tube and from transfixing the lumen of the tube with a ligature. Evidence, of necessity only circumstantial, indicates that endometriosis also arises from uterine and tubal mucosa transplanted by the surgeon.

The prophylaxis of postsalpingectomy endometriosis lies in the more careful selection of cases in which the uterus is retained after salpingectomy and in the more careful operative technic in the removal of the tube. Since we have appreciated the latter, it has been our

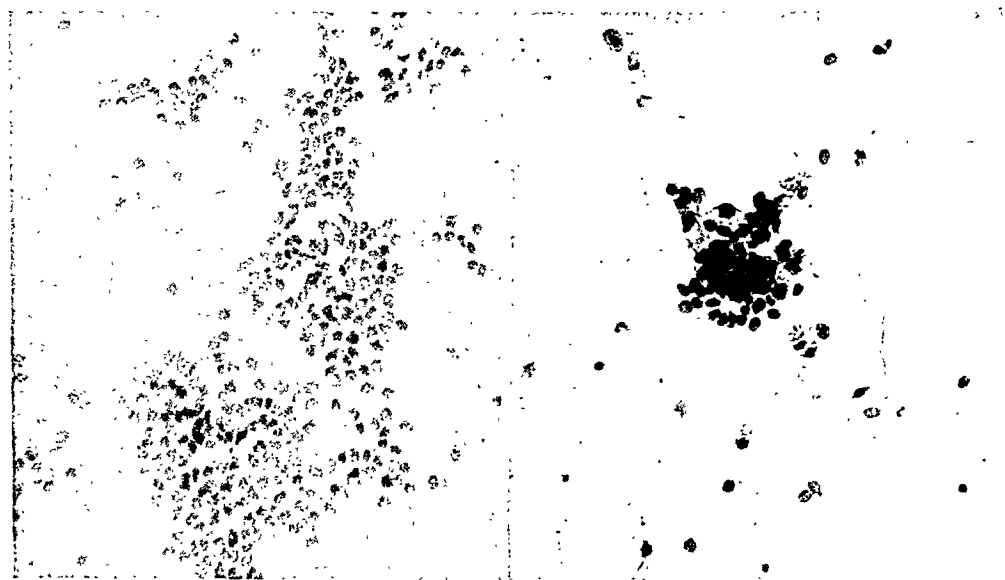


Fig. 35.—Two photomicrographs (x 130) of smears made from a small bit of wet gauze held in a clamp and introduced into the peritoneal cavity.

The first was obtained from gauze introduced into the pelvis between the posterior surface of the uterus and coils of intestines. Probably all of the cells shown in this photomicrograph are mesothelial cells. The second was obtained by carefully exposing the fimbriated end of the tube and drawing the gauze across its surface. The cells differ from those shown in the preceding illustration and are probably epithelial cells. In every abdominal operation many mesothelial cells must be transplanted in the abdominal wound. Occasionally epithelium from the fimbriated end of the tube is transplanted into the abdominal wound by withdrawing gauze which came in contact with the tubal fimbriae, even in appendicectomy. If tubal epithelium transplanted during salpingectomy grows, it might also grow when transplanted from the fimbriae of the tube.

custom to sever the tube with a cautery and to bury the stump in the uterine cornu without clamping it or piercing it with the needle carrying the suture.

#### ENDOMETRIOSIS OF THE ABDOMINAL SCAR FOLLOWING OPERATIONS OTHER THAN SALPINGECTOMY

Endometriosis in this situation has been reported following all abdominal operations on the pelvic organs. (See cases collected by Nicholson and others.) In some of these, neither the lumen of the

tube nor the uterine cavity has been exposed, nor had the latter been pierced by a needle carrying a suture. Cases also have been reported following appendicectomy in women.

It has been shown that when an abdominal operation has been preceded by a curettage, blood containing bits of uterine mucosa, at times, escapes from the uterine cavity through the lumen of the tubes, and that this "cellular spill" is increased by the operative manipulation of the uterus. In such operations these bits of uterine mucosa might be transplanted in various parts of the operative field, including the abdominal wall. Should the abdominal operation not be preceded by a curettage, the operative handling of the tubes might transfer epithelium from the fimbriae to other parts of the field of operation. Peritoneal endometriosis might have been present in some of these cases at the first operation.

How could tubal epithelium possibly be transferred to the abdominal wound in appendicectomy? We have studied this particular problem in the following manner. In pelvic operations, in which the appendix was removed, care was exercised not to touch its tip. After its removal smears were made by drawing the tip of the appendix over the surface of glass slides. Similar smears were made from the fimbriated ends of tubes. Some of these preparations were examined without fixation and staining. Others were stained with methylene blue and others were fixed in Zenker's or in Helly's solutions and stained with hematoxylin and eosin. Many cells, isolated and in clumps, were found in these preparations. Obviously smears from the appendix should contain mesothelial cells and those from the fimbriae of the tubes both mesothelial and epithelial cells. A comparative study of the slides from the two sources should enable one to distinguish the mesothelial from the epithelial cells. As a further control, tubes and uteri were carefully split open and scrapings were made with a sharp knife or a small piece of gauze held in a clamp from the surfaces of the mucosa thus exposed. These were spread on slides and treated as were the previous ones. We have been studying this problem for over a year and have examined many slides from many patients and have not yet found a satisfactory method of always distinguishing these two cells, especially when they are isolated. Nevertheless, we can sometimes be sure of our findings and have shown that tubal epithelium may be transferred to a glass slide by brushing the fimbriae over the surface of the slide. In like manner tubal epithelium could be transferred by the surgeon to the abdominal wound or any other part of the operative field, if he handled the fimbriated end of the tube.

The second phase of the study of the problem was conducted in the following manner: At operation a small wet piece of gauze, held in a clamp, was inserted in the pelvis between the posterior surface

of the uterus and the coils of intestines and withdrawn. Smears on slides were made from these. We were astonished at the large number of mesothelium cells found, thus indicating the trauma caused by inserting gauze into the peritoneal cavity, even a small piece of wet gauze. After carefully exposing the tubes, similar gauze bits were rubbed against their fimbriae and smears made from these. The histologic findings (Fig. 35) were identical with those obtained by brushing slides with the tubal fimbriae. Similar observations were made in appendicectomies through a McBurney incision.

These observations showed that gauze introduced into the peritoneal cavity in any form, as a tampon or bit in a sponge stick, removes a large amount of the mesothelium from the surface of the organs and structures, with which it comes in contact and that in every operation some of this mesothelium must be transferred to the tissues of the abdominal wound on removing the gauze. These observations also show that should the gauze come in contact with the fimbriae of the tube, even in appendicectomies through a McBurney incision, tubal epithelium will, at times, be transferred to the abdominal wound on removing the gauze. The surgeon, therefore, always transplants a large number of mesothelial cells into the tissues of the abdominal wound in every abdominal operation and sometimes transplants tubal epithelium. We have already presented evidence indicating that tubal epithelium transplanted by the surgeon in salpingectomy may, at times, give rise to endometriosis. Why should not tubal epithelium transplanted by gauze or any other operative procedure from the fimbriae of the tube do the same?

The presence of endometrial tissue in laparotomy scars was discussed by Heaney<sup>10</sup> at the 1925 meeting of the American Gynecological Society. He collected 29 cases from the literature. Seven of these followed operations in which the pregnant uterus had been opened by intent or accident. He added 2 of his own to the latter. Abstracts of these cases may be found in his paper. Danforth<sup>11</sup> reported an additional case at the same meeting.

If endometrial tissue in laparotomy scars after the incision of the pregnant uterus develops from bits of uterine mucosa transplanted

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Fig. 36.—Posterior view (natural size) of the left uterine cornu with a piece of the rectus muscle fused with the latter at the seat of tubal sterilization (Case 5). See Figs. 28, 29, and 37. The fundus of the uterus was fixed extraperitoneally to the anterior abdominal wall. Peritoneal implants (*imp.*) are present beneath the tube and possibly arose from the tubal sterilization when the tube was severed close to the uterus and its ends ligated.

Fig. 37.—Cross-section (natural size) of the uterine cornu and a portion of the rectus muscle which was fused with it (Figs. 28 and 36). An endometriosis is present in the uterine cornu and also in the rectus muscle (Fig. 29). Cavities in the latter, dilated with blood, are brown in contrast with the red muscle.

Fig. 38.—Cross-section (natural size) of an abdominal scar with endometriosis in the subcutaneous fat (Case 7). Section was taken either just below or above the bleeding fistula. Evidence of the latter can be seen in the pigmented skin. The gross appearance of and the histologic structure (Fig. 34) of the endometriosis in this case were identical with that of the preceding. The latter arose from tubal mucosa by direct extension. The latter, I believe, also arose from tubal mucosa but by transplantation.

by the surgeon, we would expect often to find a similar condition in the uterine scars and in near-by pelvic structures following these operations. Schwarz<sup>12</sup> has recently reported an additional case of endometrial tissue in the abdominal scar following cesarean section. He states that in his study of the cesarean scar of the human uterus, he has found endometrial tissue along the line of incision in two instances. In his experimental study of the cesarean scar in the guinea pig, endometrial tissue was found in several cases along the line of incision as well as on the peritoneal surface of the uterus. Circumstantial evidence would indicate that the müllerian mucosa found in laparotomy scars after cesarean section arose from the growth of uterine mucosa transplanted by the surgeon and not from tubal epithelium. We have shown that tubal mucosa injured by salpingectomy may invade the tubal stump and structures adherent to it and that this misplaced müllerian mucosa may assume the structure of the uterine mucosa and even its function. It is possible that in some of the cases of endometriosis of laparotomy scars following cesarean section, the müllerian mucosa in the scars was of tubal and not of uterine origin, as in the cases where the uterine cavity was not opened.

#### POSTOPERATIVE VAGINAL ENDOMETRIOSIS

Peritoneal endometriosis is found more frequently in the posterior culdesac than in any other situation. Based on the serosal theory for the origin of this condition, the peritoneum of the posterior culdesac must be richer in potential müllerian mucosa than any other portion of the peritoneum. If endometriosis of laparotomy scars arises from the differentiation of peritoneum included in that scar, and especially the peritoneum of the abdominal wall which apparently is relatively poor in potential müllerian mucosa, we would certainly expect frequently to find an endometriosis of the vaginal vault following panhysterectomy or any other operation by which bits of the peritoneum of the posterior culdesac might be transplanted in the vaginal wound. If the endometriosis of laparotomy scars arises from the growth of bits of uterine mucosa transplanted by the surgeon, we would expect frequently to find a similar condition in the vaginal scars after labor and after a repair of the pelvic floor which has been preceded by a curettage of the uterus. We have been studying the small cysts frequently found in vaginal scars and have encountered only one with a histologic structure similar to that of ectopic müllerian mucosa.

The rarity of possible postoperative endometriosis in vaginal scars fails to support either the serosal or the mucosal origin of endometriosis of laparotomy scars. Are vaginal tissues ill suited to the growth of müllerian mucosa? Endometriosis of the posterior vaginal vault frequently arises from the direct extension downward of similar tissue in the culdesac.

Tubal epithelium is much more frequently transplanted in abdominal than in vaginal wounds. Tubal epithelium apparently plays a large part in the etiology of endometriosis of abdominal scars. Could it be possible that tubal epithelium can be more successfully transplanted than uterine?

BEARING OF THE PRESENT STUDIES ON THE ORIGIN OF PERITONEAL  
ENDOMETRIOSIS OTHER THAN POSTOPERATIVE

The evidence indicating that peritoneal endometriosis, at times, arises from the implantation of müllerian epithelium escaping through or from the tubes may be summarized as follows:

1. It occurs in women and not in men.
2. It is an acquired lesion and usually (possibly always) develops during the menstrual life of women and most frequently in the latter half of that life.
3. Experiments in the autotransplantation of bits of müllerian mucosa in the lower animals by Jacobson and others show that it may be successfully transplanted to the peritoneum of these animals.
4. The study of postoperative endometriosis in women shows (or at least suggests) that tubal and uterine epithelium may be successfully transplanted by the surgeon.
5. The study of endometrial tissue in the ovaries suggests that this tissue may spread to the peritoneum by the implantation of epithelium which escapes from the ovary both through the perforation (menstrual) of endometrial cysts and also the menstrual reaction of endometrial tissue on the surface of the ovary. This evidence is purely circumstantial, but, to me, it is most convincing.
6. Peritoneal endometriosis often occurs without any discernible endometrial tissue in the ovaries, the latter, therefore, not being essential in the development of the peritoneal lesion.
7. One of the outstanding features of patients with peritoneal endometriosis is that the tubes are usually patent. In 342 patients with peritoneal lesions containing endometrium-like tissue (other than postoperative), encountered by me in the last six years, both tubes appeared to be patent in 330. A unilateral hematosalpinx was present in 3 and bilateral hematosalpinx in 4. Patent tubes apparently increase the incidence of peritoneal endometriosis and the relatively large number of patients with hematosalpinx must be of some significance. In the cases with occlusion of both tubes, the peritoneal lesions might have been present prior to the closure of the fimbriated ends of the tubes.
8. The peritoneal lesions often occur in situations and under conditions indicating their origin from material escaping from or through the patent tubes.

9. The present study shows that the traumatized mucosa of the tubal stump (after salpingectomy) may not only invade the stump but also any structure adjacent or adherent to it and give rise to the lesions of peritoneal endometriosis, including typical endometrial cysts or hematomas of the ovary.

10. These same studies show that this misplaced tubal mucosa may assume the structure of the uterine mucosa. Therefore, many of the endometrium-like lesions of peritoneal endometriosis could be of tubal and not of uterine origin.

11. It has been shown that bits of the uterine mucosa, set free by curettage, may be carried by blood escaping from the uterine cavity into the tubes.

12. It has also been shown that, during menstruation, blood may escape from the uterine cavity into the tubes and that this blood may contain bits of the uterine mucosa.

13. We have evidence<sup>13</sup> indicating that bits of the uterine mucosa may escape into the venous circulation of the uterus during menstruation and become implanted in the venous sinuses of the uterine wall.

14. Since peritoneal endometriosis develops during the menstrual life of women and as the menstrual reaction is one which often causes a dissemination of bits of uterine mucosa and possibly also of the tubal mucosa, it is natural to look upon it as an important factor in the dissemination of müllerian epithelium into the peritoneal cavity.

15. Tubal epithelium might readily escape from the tubal fimbriae independent of menstruation.

16. The evidence thus far obtained shows that peritoneal endometriosis might arise from the implantation of both tubal and uterine epithelium.

17. The present studies support this theory and emphasize the origin of peritoneal endometriosis from the implantation of tubal epithelium, but do not exclude its origin from other sources.

#### THE BEARING OF THE PRESENT STUDIES ON THE ETIOLOGY OF ENDOMETRIUM-LIKE TISSUE IN THE OVARIES OTHER THAN POSTOPERATIVE

These studies demonstrate that the traumatized mucosa of the tubal stump may, by direct extension, invade the adjacent ovary and give rise to typical endometrial cysts or hematomas of that organ (3 cases) and in one instance endometrial tissue on the surface of the ovary apparently arose from the implantation of tubal mucosa from the tubal stump. As has been emphasized, the tubes are usually patent in patients with endometrial tissue in the ovaries and the endometrial lesions on the surface of the ovaries nearly always occur on the lateral and under surfaces of that organ in situations readily contaminated by material escaping from the patent tubes and where that



material would be protected and held in place, thus favoring the "taking" of the graft. Circumstantial evidence indicates that, at times, endometrial tissue in the ovaries arises from the implantation of epithelium escaping from and through the tubes. Because a variety of epithelial structures arises in the ovaries, it is natural to assume that the endometrium-like tissue in that organ, at times, might arise from other sources than the implantation of epithelium escaping from and through the tubes.

These studies support the theory that endometrium-like lesions in the ovaries may arise from the implantation of müllerian epithelium escaping through or from the tubes. It emphasizes the part played by tubal epithelium, but it does not exclude its origin from other sources.

#### SUMMARY

1. Endometriosis was found in and about the tubal stumps in 30 of 36 patients who had had a previous salpingectomy or tubal sterilization.

2. Postsalpingectomy endometriosis usually arises from sprouts growing out from the traumatized mucosa of the tubal stump. These sprouts may invade not only the wall of the tube but also the uterine cornu and any structure adjacent or adherent to the stump, such as the tissues of the broad ligament, the ovaries (3 cases), and even the abdominal wall (2 cases).

3. The misplaced tubal mucosa in these lesions, at times, retains its original structure and at other times assumes both the structure and function of the uterine mucosa including its reaction to menstruation and pregnancy. It presents the histologic picture of endometriosis of nonoperative origin including typical endometrial cysts or hematomas of the ovary.

4. In the various operative procedures, incident to salpingectomy, bits of tubal and uterine mucosa may be transplanted by the surgeon both in the immediate field and also in remote ones. Endometriosis, with the same histologic structures as that present in sprouts, springs up as seedlings in situations where tubal and uterine epithelium might have been sown. It is natural to assume that some of these seedlings sprang from epithelium transplanted by the surgeon.

5. If tubal epithelium transplanted during salpingectomy grows, it should also grow if transplanted during other operations than salpingectomy and by other means than operations.

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## CYCLICAL AND OTHER VARIATIONS IN THE TUBAL EPITHELIUM

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UP TO 1908 the expression "menstrual cycle" meant little more than the periodic recurrence of a physiologic hemorrhage from the uterine cavity. In that year Hitschmann and Adler, in one of the really epoch-making contributions to gynecologic literature, demonstrated that the endometrium exhibits a cycle of histologic changes which involve all three of its constituent elements, i.e., the epithelium, the glands, and the stroma. Even before this a good start had been made in the demonstration of a definite histologic cycle in the ovary, chiefly in the pioneer work of Fraenkel and others upon the life cycle of the corpus luteum. The attempt to correlate the two cycles was a natural sequence. From a histologic and chronologic standpoint this offered little difficulty, but the physiologic interrelationships of the two cycles constitute a problem which, in spite of the great advances of recent years, still remains unsettled.

The demonstration that the vaginal mucosa of the lower animals likewise undergoes a regular cycle of histologic changes culminated in the discovery by Stockard and Papanicolaou, in 1917, that this vaginal cycle can be easily followed by examining the cell composition of vaginal smears. This simple test has enormously facilitated the study of the sex cycle in laboratory animals.

Whatever the underlying sex impulse may be, it obviously affects very profoundly all tissue derived from the müllerian ducts. Only in the cervix and the tube does it remain to describe a histologic cycle comparable to that in the uterus, ovary, and vagina. It is true that in the human being the vaginal cycle has not as yet been very satisfactorily demonstrated. Indeed, we know of only one adequate study of this subject which has as yet been made, that of Diercks in 1927.

With regard to the cervix, also, no evidence has as yet been adduced to indicate that it participates in the constantly changing histology of the genital mucosa, although one would expect that it must possess some sensitivity, however vestigial, to the sex stimulus. In the course of the investigations we are to describe in this paper, we have

incidentally had occasion to study many cervixes removed at different phases of the cycle, but have not been able to detect any changes suggesting a cyclical influence.

The present communication deals with the study of a rather large number of tubes, in an effort to describe perhaps more fully than has hitherto been done any histologic cycle of changes which might be demonstrable in the tubal epithelium and to correlate this, if possible, with the now clearly defined cycle which occurs in the endometrium. Moreover, we have thought it worth while to study, in a small series of cases at least, the tubal epithelium in patients with certain disturbances of ovarian function, particularly functional uterine bleeding. This seemed of especial interest in that this functional disorder is associated with a characteristic histologic change in the endometrium (hyperplasia of the endometrium). Finally, we have endeavored to study the characteristics of the tubal epithelium in fetal life, in childhood, in senility, and during pregnancy.

Heretofore the possible participation of the tube in the menstrual process has been discussed almost entirely from the standpoint of the menstrual bleeding alone, and much has been written on both sides of the question of whether or not the tubal mucosa exhibits a physiologic bleeding, like that of the endometrium. We shall have occasion to touch upon this point later, but in this paper our chief purpose is to present observations which emphasize the fact, so well illustrated in the endometrium itself, that bleeding is only one of the manifestations—much less fundamental than some of the others—characterizing the menstrual phenomenon.

#### HISTORICAL

In view of the paucity of studies on this subject in the English language, it seems worth while to submit a fairly complete survey of its historical development, for the benefit of subsequent workers. The literature up to 1908 is thoroughly reviewed by Schaffer, to whose article we are indebted for a number of citations from publications which would otherwise have been inaccessible to us.

The traditional description of the tubal epithelium, and the one found in almost all modern textbooks, is of a single layer of ciliated columnar epithelium. This statement is so incorrect, if made unqualifiedly, that it is difficult to see how it has been perpetuated, especially in view of the fact that its incorrectness was pointed out by Frommel as far back as 1886. In a short communication before the German Gynecological Society this observer called attention to the fact that the tubal epithelium is made up of two chief types of cells, one ciliated, and the other nonciliated and apparently secretory. He also described another type, a rod-like cell, with a flat compressed nucleus and no cytoplasm. This is undoubtedly the cell which was later spoken of as the "Stiftchenzelle," as will be discussed later in this paper. Frommel's first studies were made upon the tubes of cats, but he extended them also to other animals (dogs, sheep, monkeys).

From time to time since Frommel's publication, other authors have corroborated his observations, without apparently making any great impress upon traditional belief. In 1890 Nicolas, for example, reported studies upon rabbits, guinea pigs, and cats, in all of which he found the two types of epithelium described by Frommel. He believes that the nonciliated cells are in the majority, and that they exhibit a considerable degree of polymorphism. This latter observation is of interest in view of the fact that not a few subsequent observers look upon this polymorphism as an evidence of transformability of one type to another.

Woskressensky (1891) was so impressed with the probable secretory importance of the nonciliated epithelium that he performed double ligation of the tubes in rabbits and other animals, interpreting the exudate between the ligatures as an accumulation of the secretion of these cells. This interpretation, it need scarcely be said, was not a justifiable one.

Tréche (1893) studied human autopsy material with essentially the same findings as Frommel. Incidentally, he concluded that cilia are present in the tube but not in the uterus, an observation which we believe places him distinctly ahead of his time, inasmuch as we have likewise come to believe that the time-honored description of cilia in the human endometrium is probably incorrect. We are studying this problem at present.

Herman (1894) believed that the polymorphism of the secretory cells described by Frommel is merely an evidence of the degenerative and regenerative changes constantly taking place, an observation which again strikes a distinctly modern chord.

Sobotta's studies (1895) were made upon the tubes of mice. He found cilia to be present in the distal portion of the tube alone, an observation which is not substantiated by later investigations. In the human being, our own work has convinced us that cilia are present throughout the length of the tube. More clearly than any of his predecessors, Sobotta called attention to the fact that the nuclei often project beyond the epithelial border, appearing to rest on the cilia of adjoining cells. This, as we shall see, is a very common and very striking picture in the human tube as well. He describes also the peculiar cells with compressed nuclei, which he suggests may be wandering leucocytes squeezing their way between the cells. This view is later shared by Bindi (1905), who adds the interesting suggestion that they may be concerned with the removal of masses of degenerated spermatozoa.

Mandl (1897) did not believe that the available evidence justified the view that a definite secretion was given into the lumen of the tube by the so-called secretory cells. Janot (1898) asserted that the cilia of the tubal mucosa disappear in pregnancy. This observation, as we shall show from our own material, is incorrect.

Chrobak and Rosthorn (1900) stated that the secretory cells are found especially in the ampulla of the tube, while the isthmus shows a predominance of the ciliated cells.

An excellent contribution was that of Voinot (1900), especially in that his material was derived from the operating room, or else was well fixed soon after death. He studied tubes from patients of all ages, and from all phases of the menstrual cycle, as well as from cases of pregnancy. Moreover, his sections were made from various parts of the tube (intramural, isthmus, ampulla, and fimbriated extremity). He found cilia absent during intrauterine life, though appearing in slight number just before birth. Up to the age of puberty he found two main types of cells, and, like Nicolas, he described various transition forms among the nonciliated cells. Among the latter he includes the "Stiftchenzellen" or "Schaltzellen." Cilia he found rare in the intramural portion, where the epithelium is of

rather regular cylindric type, with few intercalary cells. Chiefly nonciliated cells are found in the isthmus and ampulla, in the latter often forming tuft-like masses at the top of the folds. In the fimbriated extremity, finally, he found the ciliated cells predominating, with considerable variation in morphology.

During reproductive life he found the cilia greatly increased in number. In the interstitial portion and the fimbriated extremity the cells are almost all ciliated, while in the remainder of the tube cilia are found chiefly at the bases and sides of the folds. The nonciliated cells are found chiefly at the tips of the folds. This arrangement Voinot believes to facilitate the passage of the ovum, which, being taken up by the cilia at the fimbriated end, enters a gutter between two adjacent folds. This groove is covered over by a roof of nonciliated cells, so that the ovum cannot readily turn aside. It is therefore pushed along to the interstitial portion, where cilia again are present in large numbers, so that it is propelled into the uterus. Interesting as these observations are, they do not agree with the results of others, or with our own findings.

Voinot made no effort to describe cyclical changes related to menstruation, for even the cycle in the endometrium was then unknown. However, in the discussion of tubes removed at menstruation, he speaks of a marked proliferation of the epithelium. In pregnancy he found the cylindrical cells to become cuboidal or flattened, only when they lie over areas of decidua formation. Finally, the study of tubes from senile women (ages sixty to ninety-five years) showed the epithelium to be cuboidal or flattened, except in the interstitial portion, where it is still cylindric. Cilia may be retained even when the epithelium has become much flattened.

The studies of Gurwitsch (1901), made upon dogs, were concerned chiefly with the relation between the cell body and the basal granules. The latter, he states, are of dumb-bell shape. Incidentally, he does not believe that the epithelium of the tube secretes, but that the so-called secretory cells are to be interpreted as developing ciliated cells.

The first American contribution to the subject was made in a short discussion by Gage in 1904. This investigator found that in young mammals the tube is lined by a cylindrical epithelium, which is chiefly nonciliated, though some ciliated cells are present. In the bat and mouse cilia were found at the fimbriated ends of the tubes.

Linari (1904), on the contrary, found the epithelium to be chiefly ciliated, although some secretory cells were present. Unlike Voinot, moreover, he found the cilia most abundant on the tips of the folds, and the secretory cells between the folds. He calls attention to the great rarity of mitoses in the tubal epithelium, an observation which we can readily endorse from our own work. He thinks this fact would indicate that very few tubal cells are lost.

Gianelli's (1904) studies yielded conclusions much like those of Linari. In addition to human tubes he studied those of dogs, sheep, cows and pigs. He thinks that the ciliated and nonciliated cells are closely related, and describes transition forms. He found the secretory cells indifferent to all the stains tried. They occur in all parts of the tube, although they become less abundant toward the fimbriated end.

The paper of Hörmann (1907), while devoted primarily to a study of the connective tissues of the tube, is of interest to us in that it discusses the nature of the so-called "peg" cells. Hörmann takes issue with von Ebner, who had suggested that these cells might be of connective-tissue type, and considers them to be secretory cells which have emptied themselves and become flattened out.

One of the most important contributions to the subject was that of Schaffer, in 1908. As already mentioned, this author presented an extremely complete his-

torical survey of the whole question. He found that the proportion and character of the secretory cells differs in different animal species, as well as in different animals of the same species, and that these differences depend chiefly upon which portion of the tube is studied and what phase of the sexual cycle is represented. In a general way, the fimbriated end is lined almost entirely with ciliated epithelium, while the secretory cells are abundant in the ampulla. At the isthmus, again, the secretory cells diminish in number, although they increase at certain phases of the cycle. Schaffer emphasizes the fact that in spite of the distribution of cells, the continuity of the ciliary action is never broken.

Schaffer is perhaps the chief proponent of the view that the secretory cells are not elements *sui generis*, but that they arise from modification of the ciliary cells. He supports this view by describing various transition phases. He discusses also the nature of the supposed secretion of the nonciliated cells. In some rodents, such as the rabbit, he believes that the cytoplasm granules suggest a mucinous character, and quotes Ellerman as having shown that in certain lower forms (amphibians) there are typical mucous cells between the ciliated ones. He agrees, however, that in most animals, including man, the nature of the secretion is not known. He does not believe that all the intercalary or "peg" cells are to be interpreted as emptied secretory cells. He calls attention to the fact that in some animals a primitive gland formation is to be seen in the fallopian tubes. Finally, he emphasizes the fact that the cilia are not by any means as perishable as many believe, and that they are easily demonstrable in fresh tissue for a considerable time after its removal from the body. The importance and ease of this method of study we shall emphasize in the report of our own work.

Hoehne (1908) studied the question of ciliation in both the uterus and tube. The former he found to show an interrupted ciliation, the latter to show a continuous ciliary stream. He was able to demonstrate cilia in the tube of a woman of sixty, who had passed through the menopause twelve years previously.

Holzbach (1908), in a comparative study of the cyclical changes in the lower animals and the human, suggests that the secretion may be of nutritional importance to the migrating egg. He believes that the muscle fibers of the tubal wall may assist in squeezing out this secretion. He found that "Stiftchenzellen" appear with the onset of estrus, and he discusses the various views which have been held as to their origin. Some of these have already been mentioned, but Holzbach calls attention to the observation made by Paneth that similar cells occur in other columnar epithelia, as in that of the small intestine, where they are to be interpreted as "rests" of goblet epithelium, which can again assume their customary form.

A second paper by Holzbach (1909) is devoted to a consideration of the question of tubal secretion. He demonstrated, by the Galeotti stain, that definite granules, presumably of the nature of a prosecretion, are to be seen in the cytoplasm of the secretory cells. The secretion is not mucin, and Holzbach again urges that it may be of importance to the nutrition of the egg. The secretory cells are increased at estrus and during pregnancy. This work was done with material from various rodents (rabbit, rat, mouse, hedgehog, bat).

Katz (1911), in the examination of five tubes in pregnancy, found the secretory cells much increased, and among them numerous cells which he considered transitions from the nonsecretory or ciliated type to the secretory.

Jägeroos (1912), in a study of 40 tubes from the premenstrual phase, gave an extremely accurate description of the two chief types of cells, as well as of their distribution. He discusses the view of Voinot, already mentioned, that at the time of menstruation there is a proliferation of the tubal epithelium, and quotes Delporte as observing that in the hypertrophied epithelium are to be seen

numerous "Stiftchenzellen," which are evidently only compressed epithelial cells. Jägeroos is inclined to agree with Schaffer as to the transformation of ciliated into secretory cells, and suggests that this transformation takes place at the time of menstruation, when the secretion is emptied and the cilia may be lost. This view is certainly incorrect, as will appear from our own studies, for the cells which possess the cilia before menstruation are not the ones which contain the secretion.

The excellent study of Moreaux (1913) is a model of painstaking and thorough histologic research. Like Schaffer, he believes that the secretory cells are derivatives of the ciliated cells, and he describes this transformation, step by step, with a precision that is most remarkable, although unfortunately it does not seem to have been corroborated by subsequent observers. The granules in the cytoplasm of the secretory cells he considers mucigenic in character. As the secretion collects, the cell bulges or herniates into the lumen, into which the secretion later is emptied. The later regeneration of the cell into a ciliated cell he ascribes chiefly to the influence of the "diplosome," represented by a pair of fine chromatin bodies, surrounded by a clear zone, and occupying different positions in the cytoplasm at different phases. Each diplosome divides and subdivides, giving an appearance like a row of diplococci, and this double row forms the basal granules of the new ciliated cell, the cilia developing from the outer row.

Moreaux divides the life cycle of the tubal epithelial cell into four phases: viz., (1) ciliation; (2) elaboration; (3) excretion; and (4) reconstruction. The stage of ciliation corresponds with estrus, i.e., with the presence of a mature follicle in the ovary. Excretion is noted after rupture of the follicles, when the corpus luteum has begun to develop, and when the ovum is going through the tube. Elaboration of secretion, therefore, he thinks is under the control of the follicle, while excretion is due to the influence of the corpus luteum. He suggests that the tubal secretion is probably of nutritional importance to the ovum, as will be discussed later.

Aschheim (1915), in his well-known study upon the glycogen content of uterine epithelium, mentions in an addendum that his pupil, McAllister, had been able to find glycogen in the tubal epithelium, although the study was still incomplete, and no relation had been demonstrated with the menstrual cycle. No later report on this work has been made, so far as we can learn.

Perhaps the most important study of recent years is that of Tröscher (1917), who studied 60 tubes in various phases of the cycle, as well as 2 fetal and 5 senile tubes. Secretory changes are not seen in the postmenstrual phase, during which the ciliated cells are predominant. In the interval, likewise, the mucosa of the ampulla particularly is lined almost entirely by ciliated cells. With the onset of the premenstrual period, however, the secretory cells are numerous and filled with secretion, and these changes persist if pregnancy supervenes.

Of his 60 tubes, 18 were from the interval phase, 15 from the premenstrual, 3 from the menstruating, 12 from the postmenstrual, while 12 were associated with pregnancy. All these tubal phases are quite adequately described. Tröscher's study is perhaps the most significant of any hitherto made from our present standpoint, inasmuch as it is perhaps the only one which has as its definite object the correlation of the tubal and endometrial cycle in the human.

The secretion, according to Tröscher, is not mucin, nor does he think that it is glycogen, although he occasionally found evidences of this substance. The "Stiftchenzellen" he believes are degeneration elements. Mitoses are rare, and are never seen in the ciliated cells. He quotes Geist, with whom he agrees, as to the nature of the changes in the tubal epithelium of the senile tubes. The folds become rounded, but the epithelium may be little changed for a considerable time, and

the basal granules may be clearly marked for a long period. Later the epithelium becomes cuboidal or perhaps almost flat.

Allen (1922) in a study of the estrus cycle in the mouse, described a characteristic extrusion of cell nuclei in the tubes during the early metoestrus, this being continued in marked degree sometimes to the middle of the following proestrus. This observation we consider of great importance from a comparative standpoint, as it would in this respect indicate a correspondence of the metoestrus in the lower animals with the premenstrual or menstrual phases in the human. On the other hand, during proestrus and estrus the nuclei of the outer third of the tube are arranged in a regular row, quite like that seen in the interval phase in the human. We shall discuss the significance of these facts later in this paper.

Snyder's studies (1923) upon the fallopian tubes of pigs demonstrated a definite cycle which closely paralleled the cycle of corpus luteum development. These cyclical changes involve not only the height of the epithelium, but also the surface and morphology of the nonciliated cells. The height of the epithelium was found to be more than twice as great when the ova are passing through the tubes (1 to 3 days after ovulation) as during the second week after ovulation, i.e., during the period of implantation. Snyder also describes the characteristic changes of the nonciliated cells after ovulation, changes which in the human being are noted in the premenstrual phase. This again emphasizes the very sharp difference in the chronology of the animal as compared with the human cycle.

In a second paper (1924) Snyder, working with human material, reported the results of his study of 75 tubes. Sixty-two of the tubes were from nonpregnant women at various phases of the cycle, and 13 were from pregnant women. He described very clearly the differences in height of the epithelium at various stages of the human cycle, with accurate measurements and beautiful illustrations. In 17 of the cases it was possible to study the endometrium also, giving opportunity for a correlation of the two cycles. Snyder's results, in the main, coincide with those of Tröschel, already referred to.

Scheyer's work (1926), on the lipoids of the tube, may be alluded to in passing, although its significance is not clear. He studied tubes from 7 patients. In the postmenstrual phase he found lipid droplets in almost all the epithelial cells. In the premenstrual period, he also found lipoids abundant in the form of fine droplets, in both the epithelial and stromal cells. Lipoids are absent in the newborn, present in moderate amount during later childhood, abundant in 18.4 per cent of tubes during the reproductive era, and reach a maximum with increasing age, with its degenerative and atrophic changes.

Finally, a very recent paper in the Russian literature, by Jacovlev (1927) deals with the question of whether or not glycogen is to be found in the tubal epithelium. This author studied the tubes from 19 patients ranging from two days to fifty-five years of age. Five of these cases had extrauterine pregnancy. Glycogen was found in only 3 cases. One of these had a uterine pregnancy, the other two had extrauterine pregnancy. In the uterine gestation no glycogen was found in the epithelium, but only in the muscle and connective tissue. In the two cases of extrauterine pregnancy, he found tiny amounts of glycogen in the remains of decidual cells and in the folds at the point of rupture. No glycogen was found in the healthy part of the tube. In the main, therefore, it may be said that his studies as to the possible importance of glycogen in the tubal epithelium were quite negative.

#### MATERIAL UPON WHICH PRESENT STUDY IS BASED

The material upon which our own study is based consists of the tubes from 136 cases. In some cases both tubes were available, in



others only one. In addition to this fairly large series, a large number of other tubes were available for investigation, not being included in the series because of such reasons as inadequate data, pathologic changes, etc. The tubes included in the series were either perfectly normal, or else showed pathologic changes which were so slight as to have no bearing upon the cycle, as determined by comparison with the perfectly normal ones. Perhaps the majority of the tubes had been removed with myomatous uteri, while others had been associated with such conditions as uterine cancer, ovarian tumors, etc. The accompanying table indicates the distribution of our cases with reference to the various cyclic or other phases which were studied. The nomenclature of the various phases, viz., postmenstrual, interval, premenstrual, and menstruating, is the one commonly employed, being based upon the histologic picture presented by the endometrium, or upon an accurate menstrual history.

Of the 116 cases embraced under the combined heads of postmenstrual, interval, premenstrual, menstruating, and pregnant phases, it will be seen that in fully 105 we were fortunate in being able to study the endometrium as well. The importance of this fact is obvious, because of the fact that the endometrial picture constitutes a far more reliable indication of the menstrual phase than does the clinical history, for menstrual histories are notoriously prone to inaccuracies. Moreover, in a considerable number, there were available sections of the ovary, which, in some cases at least, furnish a further check upon the chronologic accuracy of the observations.

TABLE I

STAGE	NO. OF CASES	NO. OF CASES	
		WITH ENDOMETRIUM	WITHOUT ENDOMETRIUM
Postmenstrual	17	15	2
Interval	62	54	8
Premenstrual	23	21	2
Menstruating	13	11	2
Pregnancy	4	3	1
Fetal	2	0	2
Senile	8	5	3
Hyperplasia with functional bleeding	7	7	0
Total	136	116	20

#### TYPES OF EPITHELIAL CELLS IN TUBAL MUCOSA

From a morphologic standpoint, three distinct types of cells may be described in the tubal epithelium, viz.: (1) ciliated; (2) nonciliated or "secretory"; (3) "peg" cells ("Stiftchenzellen"). While certain basic characteristics of these cells may be described in a general way, a study of any considerable number of tubes will at once impress one with the fact that they undergo striking variations at different phases

of the cycle, both as regards their individual morphology and also their distribution in the tube. These cyclical changes will be more fully discussed in the next section. The chief characteristics of these three types may be briefly summarized as follows:

1. *Ciliated Cells*.—These are most easily studied in the interval phase, when they reach their greatest development (Fig. 6). At this stage they are both tall and broad, measuring often as much as 30 to 35 microns in height, and as much as 12 microns in breadth. The cytoplasm is very pale staining and often almost refractile in appearance, although, by oil-immersion study, it will be found to show numerous fine granules, especially near the nucleus. The latter is quite large, and either round or, more often, slightly ovoid. Its long axis is not infrequently placed at right angles to the long axis of the cell. It is situated far above the basement



Fig. 1.—Tubal epithelium at end of menstruation, corresponding to endometrium shown in Fig. 2. The cells are low, the ciliated variety being still quite wide, and the nonciliated having given off their secretion, leaving only the nuclei. Most of the cells in the strip to the left are clearly ciliated, those on the right nonciliated. Note the dark rod-like "peg" cells at *x*.

membrane, often near the ciliated edge of the cell. This is in striking contrast with the nuclei of the nonciliated cells, which are much more deeply placed near the basement membrane (Fig. 6). This fact gives one, at first glance, the impression of a double layer of nuclei, the superficial belonging to the ciliated cells, the deeper to the nonciliated cells.

The differentiation of the two types is further facilitated by the difference in staining reaction, the nuclei of the ciliated cells taking rather a pale hematoxylin stain, as against the solid and darker stain of the nuclei of the nonciliated cells. The cilia are attached to a layer of basal granules, which, under proper magnification, stand out quite sharply. The cilia themselves, even in the fixed section, are quite long and slender, often measuring 7 or 8 microns in length. As many as a dozen or so are commonly to be seen in the ordinary section, with the high power. In many fixed sections, however, they show much clumping and agglutination, so that they cannot be readily recognized.

In the immediately postmenstrual phase the ciliated cells are much shorter than in the interval (Fig. 1), but they rather rapidly increase in height, as will be emphasized later (Fig. 3). Perhaps even more striking is the increase in breadth in the interval as compared with the postmenstrual phase. Beyond the interval, as we shall see, the ciliated cells again become low, and the minimum of height is seen in association with pregnancy (see below).

The simplest and most satisfactory manner of studying the cilia is in freshly removed unfixed tissue, primitive though this method may seem. It was, indeed by this method that the presence of cilia in the uterine epithelium of the sow was first demonstrated by Nylander as far back as 1851. The simple technic employed by this early investigator is still the best, and has been utilized by a number of subsequent workers. It consists simply in snipping off a tiny, thin bit of mucosa, placing it on a slide, flattening it out into a thin layer by pressure, and studying under the ordinary high dry lens. It is not necessary to add any physiological



Fig. 2.—Endometrium from same case as that represented by tube in Fig. 1. This is the characteristic picture at the end of menstruation, showing the regeneration of the epithelial surface from the stumps of the uterine glands.

solution such as normal saline, Ringer's or Locke's. The cilia are of course best seen when part of the illumination is shut off. They retain their vitality for a surprisingly long time after removal of the tissue from the body, even when no effort is made to keep it warm. For the first hour or two their motility is vigorous, but we have noted definite ciliary activity for as long as four hours after the operation at which the tissue was removed.

The study of the cilia by this technic is a very fascinating one. To one who has not previously seen these cilia in action their vigor is apt to be most surprising. Even before the cilia themselves are discerned, one is often made sure of their presence by the considerable commotion which they create in their vicinity, especially among the red corpuscles which are commonly found in considerable number in sections prepared by the above technic. The cilia, too, appear much longer than in the fixed sections, at times seeming to be half the length of the cells themselves.

The cilia lash to and fro in surprisingly vigorous fashion, the direction of their propulsion being apparently always the same. One will often observe a red corpuscle being propelled along by this mechanism, the direct propulsion being assisted by the ciliary current of fluid which the beating of the cilia brings about. Whatever one's ideas may be as to the normal propulsion of the ovum the study of living cilia by this method will make it easy for him to believe that the cilia themselves, together with the ciliary current, are sufficient to explain the tubal transmigration of the egg, without the assistance of muscular peristalsis.

We have had the opportunity of studying the behavior of live cilia in tubes from all the phases of the cycle, as well as during pregnancy, and have not failed to find them under any of these conditions. This corresponds with our studies of fixed and stained tissues, for here likewise ciliated epithelium is to be seen at all these physiologic phases. Furthermore, as we shall see, they are

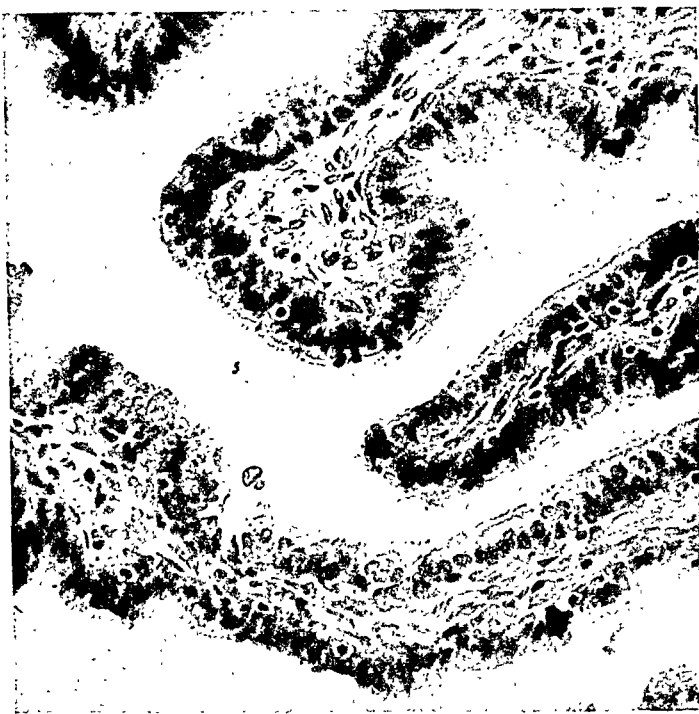


Fig. 3.—Tubal epithelium on sixth day of cycle, corresponding to endometrium shown in Fig. 4. The cells have already become quite high and narrow. There is no evidence of secretory activity. Cilia are well shown.

also found in the tubal epithelium long before puberty and long after the menopause. This suggests that they may have some function other than, or in addition to, that of assisting in the propulsion of the ova. Hartman (personal communication) suggests, with much plausibility, that their chief function may be merely that of keeping the tubal lumen cleansed of any foreign material.

2. *Nonciliated or "Secretory" Cells*.—These cells have been the object of even more extensive investigation than the ciliated cells, but as yet comparatively little is known as to their significance. From a morphologic standpoint, with which we are for the moment most concerned, there can be no doubt as to their essential difference from the ciliated elements. Like that of the ciliated cells, their height varies at different phases of the cycle. They are low immediately after menstruation (Fig. 1), become tall in the interval, remain tall in the premenstrual period (Fig. 8), and again become lower during menstruation (Fig. 12) and pregnancy (Fig. 14). In the postmenstrual period they are, like the ciliated cells, of narrow

cylindrical shape, so that at this time it requires a little sharper scrutiny to differentiate them from the latter. (Fig. 3.) The chief points of distinction, at this time, aside from the presence or absence of cilia (with proper allowance for absence due to imperfect preservation or preparation), are the shape, size, and staining of the nuclei, already described, the shape of the cell, and the staining of the cytoplasm. The latter is considerably darker and more uniform than with the ciliated cells.

In the interval phase the distinction between the two types is much more clearly marked (Fig. 6), partly by the increased width of the ciliated cells, their more easily recognized cilia, and the clear appearance of their cytoplasm, and partly by certain changes which now manifest themselves in the secretory cells. Whereas in an earlier phase these are narrow, almost rod-like in appearance, their free borders now become wider and perhaps slightly convex. There is thus produced an appearance suggesting a small cupola at the top of many of these cells, the cytoplasm



Fig. 4.—Endometrium from the same case as that shown in Fig. 3. A typical post-menstrual picture is seen with almost straight and very narrow glands.

appearing to herniate through the cell membrane, to use the term of Moreaux. The cell as a whole thus changes its shape, so that it becomes pear-shaped, or, perhaps from compression of its center by surrounding cells, dumb-bell shaped.

This variation in the shape and appearance of the nonciliated cells becomes more marked in the later stages of the interval. It is accentuated by the fact that, synchronously with this developmental phase shown by many cells, others exhibit changes which are apparently involutional or degenerative. The dome-like cell extremities appear to break into the tube lumen, leaving the nucleus with little or no discernible cytoplasmic envelope. Frequently too, the nucleus may be extruded into the lumen in a manner similar to that described by Allen in the tube of the mouse and by Hartman for the opossum. (Figs. 10 and 11.) This extrusion of nuclei is one of the most perplexing of all the phenomena. It can be taken as indicative of the death of the cell, but, extensive as the process often is, there is no evidence in the tubal epithelium of any regenerative activity. Mitoses are

almost never seen in the tubal epithelium, unlike the endometrium, where, during the postmenstrual phase, they are found in large numbers in both epithelium and stroma.

Another puzzling feature is the fact, already mentioned, that developmental and retrogressive changes proceed side by side, so that the reaction of the secretory cells to whatever the underlying stimulus may be appears to be to a considerable extent an individual one. Certainly, however, it seems to be true that as the cycle advances toward the next menstrual period, there is an accumulation of cytoplasmic substance, commonly construed, on as yet very incomplete evidence, to be in the nature of a secretion.

With the advent of the premenstrual period itself, these changes become more pronounced, and another very striking feature is added. Whereas up to this time the ciliated and nonciliated cells are of about the same height, there now appears

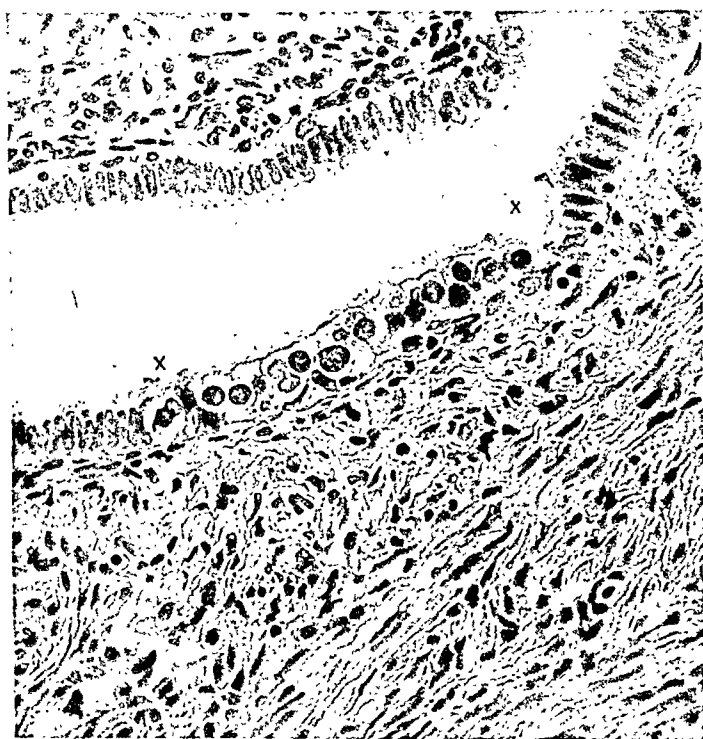


Fig. 5.—Tubal epithelium near the isthmus of the tube, showing the frequently patchy distribution of the two types of cells. Most of the cells in the strip of epithelium between the points marked *x* are ciliated, while most of the remainder shown in this slide are nonciliated or secretory. There is no evidence of secretion, as the tube was removed during the postmenstrual phase.

a marked disparity, so that the epithelial border becomes very irregular. (Figs. 8 and 10.) This is due less to an increase in the height of the nonciliated cells than to an actual diminution in the height of the ciliated elements. The free borders of the former thus often project for a considerable distance above their ciliated neighbors, presenting a striking and characteristic picture. (Fig. 8.) The bulging ends of the "secretory" cells overhang the cilia, while extruded clumps of cytoplasm, often containing the cell nuclei, are to be seen, either matted to the cilia or else lying free in the lumen.

Nuclei are often seen lying quite naked on the free border, the cytoplasm having been emptied into the lumen. Such nuclei are often wedge-shaped or triangular, being dove-tailed into the subjacent cells. Often they retain a small amount of cytoplasm, suggesting that they retain a capacity for further cyclic change.

Still another factor which contributes to the premenstrual picture is the frequent occurrence of the "secretory" cells in clusters or tufts, not infrequently at the summits of the folds. Such clusters, sharply marked off from the adjoining ciliated cells, are made up of groups of from three or four to twelve or fifteen closely packed nuclei, with a varying amount of cytoplasm. (Fig. 8.) So closely placed are the nuclei that they often, at first glance, give the impression of a single giant nucleus. Sharp focusing, however, will reveal the outlines of the individual nuclei. This impression of crowding and compression is due partly to the increased development of the "secretory" cells, and partly to the elbowing of the ciliated cells, now much increased in width.

The changes in the secretory cells characterizing the premenstrual epoch are continued into the phase of actual menstruation, except that the cells become lower, and the cytoplasmic and nuclear extrusion is completed. At the end of menstruation

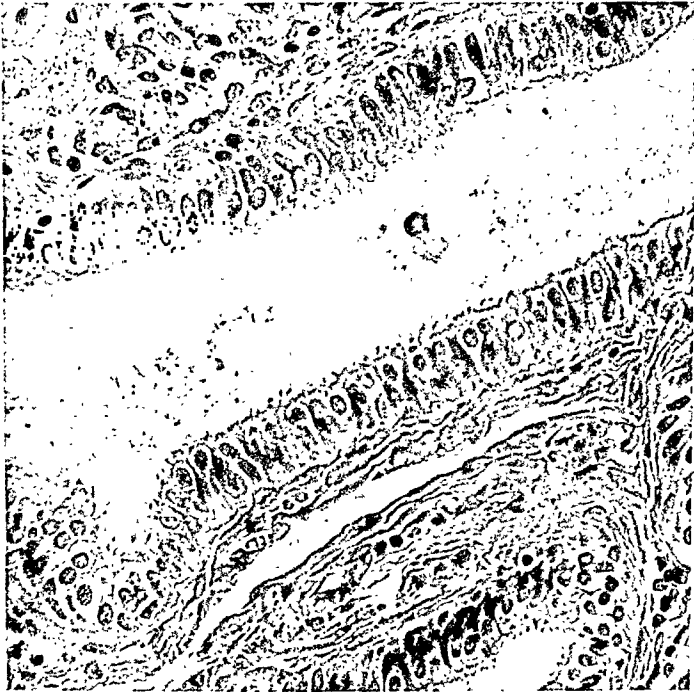


Fig. 6.—Tubal epithelium in the interval phase. Note the tallness of the epithelium, and the uniformity of the two types of cells, which are easily distinguishable in the picture. Note also the appearance of two rows of nuclei. The more superficial, rounded ones mark the ciliated cells; the darker ones, lying more deeply, mark the nonciliated cells. Cilia are seen in large numbers, but close examination shows that none of the secretory cells are ciliated. The endometrium of this case is shown in Fig. 7.

these cells appear to consist almost entirely of nucleus, although some of them show a moderate cytoplasmic envelope. (Fig. 1.) As with the ciliated cells, however, they soon become taller, assuming the slender cylindric outline already described as characterizing the postmenstrual period. (Fig. 3.) These cyclic changes will be further discussed later in this paper.

3. *Intercalary or "Peg" Cells ("Stiftchenzellen" or "Schaltzellen")*.—These cells are in many respects the least understood of the three types to be found in the tubal epithelium. Their characteristics can perhaps best be studied in the premenstrual and menstrual periods, when they are present in largest number. At these periods they present a rather striking appearance, being interjected at frequent intervals between groups of cells of the other two types. At first sight

they seem to consist of nothing but long, slender rod-like nuclei which are squeezed in between the adjoining cells. (Fig. 1.) It is for this reason that they may be spoken of as "peg cells," for they look not unlike slender pegs driven between the other cells. Throughout the literature they are rather commonly designated by the German term "Stiftchenzellen," or, by a few authors, as "Schaltzellen." The term "intercalary cells," employed by Voinot, would seem to be a very appropriate one.

While, with the ordinary hematoxylin-eosin stain, these cells most characteristically appear as intensely dark dashes between the neighboring cells, the nuclei not infrequently appear as wedge-like masses of nuclear material close to the basement membrane. By careful examination under the higher power, one will often discern a small amount of cytoplasm about the nucleus; sometimes most marked



Fig. 7.—Endometrium from the same case as that represented by Fig. 6. The picture is that of a rather late interval phase, with moderately tortuous glands, but no secretory activity of the epithelium.

at the base of the cell, sometimes near its free border, sometimes in both these regions. In the latter case the cell may be almost dumb-bell shaped. Under these conditions it cannot be distinguished from the "secretory" cell at a certain phase, as one will appreciate from the description already given of the latter cells. For example, in the menstruating tube, many of the "secretory" cells, emptied of their secretion, or, at any rate, deprived of the cytoplasm which has been thrown off into the tubal lumen, appear as peg cells.

For this reason, i.e., because we have been able to distinguish definite transition stages between these "peg" cells and the fully formed "secretory" cells, we believe that there is little doubt that the two represent different phases of the same life cycle. A number of other authors are inclined to the same view (Frommel, Mandl, Hörmann, Holzbach). If this conception is correct, it would indicate not only that the function of these cells is to form a cytoplasmic material which is



given off into the tube, but also that the cell, after this material is given off, still retains its vitality, and can perhaps repeat this process more or less indefinitely. This would perhaps explain the rarity of mitoses in the tubal epithelium.

This conception of the nature of the "Stiftchenzellen" is, however, by no means accepted by all authors, for a number of other theories have been suggested. Sobotta and Strahl, for example, suggested that these cells are only wandering leucocytes squeezing their way through the epithelium. This view is certainly incorrect, for morphologic if for no other reasons. It is true that migrating blood cells are often to be seen penetrating the epithelium, but their appearance is totally different from that presented by the cells under discussion. Reference has also been made to the view advanced by Bindi, a corollary to Sobotta's, to the effect that the intercalary cells, representing wandering blood cells, are concerned with the removal of degenerated spermatozoa from the tubal lumen.

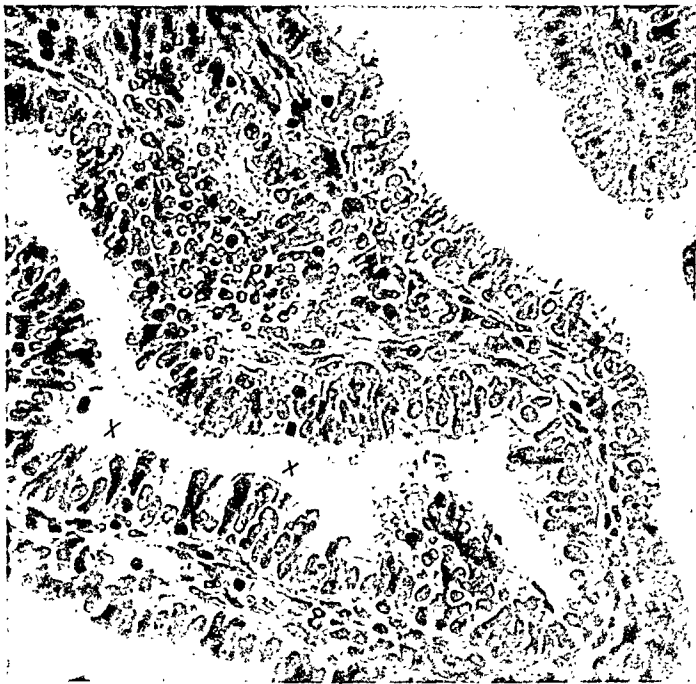


Fig. 8.—Tube in premenstrual phase, corresponding to endometrium shown in Fig. 9. The characteristic picture is especially well seen at *x*. Note the difference in height between the ciliated and the secretory cells, the nuclei of the latter protruding far above the margin of the now low ciliated cells. The cluster-like arrangement of the secretory cells is also seen. The irregularity of the border is often so marked that such tubes infrequently cannot be recognized at a glance even with the low power.

The interesting view advanced by von Ebner, to the effect that these cells are really of connective tissue rather than epithelial type, is one with which we were ourselves intrigued at first. Frequently these cells can be seen apparently arching or bending up into the epithelium from the underlying connective tissue stroma, and their nuclei are not unlike many of the long, narrow, and dark-staining nuclei of the connective tissue cells. Closer study, however, inclined us to believe that the suggestive pictures above mentioned were usually explained by the angle at which the particular epithelial strip had been cut. Furthermore, as we have already indicated, we were able to demonstrate intermediate stages between the "peg" cells and the fully formed secretory elements, so that we felt that there is no doubt of the epithelial nature of the former.

Schaffer does not believe that all of the "peg" cells represent emptied and compressed secretory cells, and agrees with the view that in part at least they represent

degenerated epithelial cells. Tröscher holds somewhat the same opinion. For this view, in the ordinary sense of the term "degeneration," we have found no evidence, unless one extends the term to the process of throwing off masses of cytoplasmic material. Reference has already been made to the view of Paneth, that these cells represent merely "rests" of secretory cells, analogous to similar rests of "goblet" epithelium, which he states occur in other columnar epithelia, such as that of the small intestine.

Finally, mention may be made of the contention of Kuhn that the intercalary cells are degeneration forms of the ciliated cells, a view which is not shared by any other investigator, and which our own material convinces us cannot be true. Throughout all phases of the cycle one must be impressed with the integrity maintained by the ciliated cells, aside from such unessential features as changes in height and width.

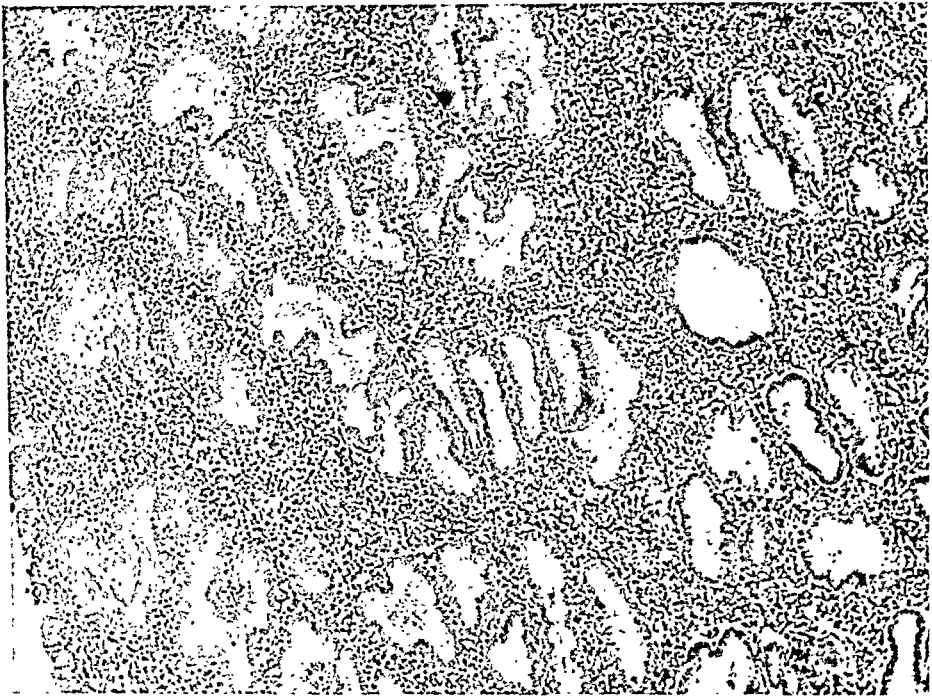


Fig. 9.—Typical premenstrual endometrium, with tortuous glands, secreting epithelium, etc. The tube from the same case as shown in Fig. 8.

#### CYCLIC CHANGES IN THE TUBAL EPITHELIUM

As stated early in this paper, the primary incentive for this study was to determine, if possible, whether a definite histologic cycle can be described in the tubal epithelium which is in any way comparable to that seen in the endometrium. While we have convinced ourselves that a cyclical variation does occur, it may be emphasized, at the outset, that it is not nearly so striking or so sharply definable as that in the endometrium. In the latter, the differentiation between the postmenstrual, interval, premenstrual and menstrual phases can be made at a glance, with a low power lens. The study of the tubal variations, on the other hand, is a much more laborious one, made only by rather tedious high-power study. Between certain phases, as be-

tween the interval and the premenstrual, the differentiation can often be quickly and easily made. In other cases, on the other hand, the distinction is made with much more difficulty.

The chief reason for this is the fact that the reaction of the tube at different phases is not a uniform one, as in the case of the endometrium. In the latter, the uterine mucosa everywhere in the normal case presents pretty much the same picture. The reaction of the tube, on the other hand, is a rather patchy one. For example, in tubes removed shortly before menstruation, the premenstrual changes predominate, but in isolated areas the epithelium may still be very tall, as in the interval. With regard to the secretory changes, the phases are even less sharply marked off, as will be discussed later. In spite of all these facts, however, nothing can be more certain than that the

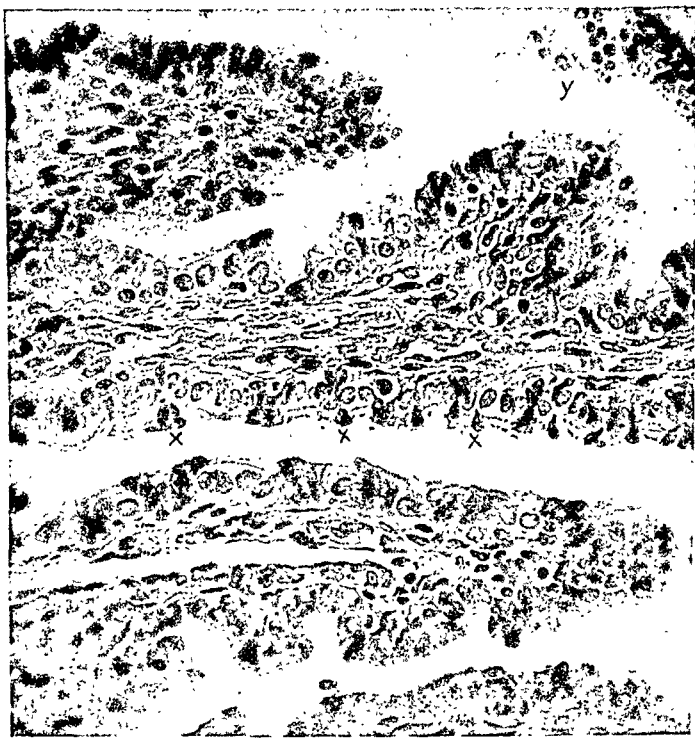


Fig. 10.—Premenstrual tube, showing (x) the peculiar extrusion of nuclei, which is seen also in many of the lower animals (cf. Fig. 11). At y is seen a collection of such extruded nuclei lying free in the lumen, and quite similar to those seen in Fig. 11.

tubal epithelium exhibits a cyclic histologic variation, so that careful study will, with rare exceptions, enable one to determine at what phase of the cycle it had been removed.

Although many of the cell characteristics at different phases have already been discussed, we shall, in the following résumé, set forth briefly our own observations as to the chief characteristics of the tubal epithelium at the various phases of the cycle. The logical method of presentation is under four heads, corresponding chronologically with the four commonly described phases of the endome-

trium; viz., postmenstrual, interval, premenstrual, and menstrual. It is not necessary to review here the characteristics of these endometrial phases. Suffice it to say that the postmenstrual phase corresponds to the first four or five days following menstruation, that this phase is followed by the interval, which in turn continues up to five or six days before menstruation. There is a tendency on the part of some recent writers to place the beginning of the premenstrual or secretory phase much earlier in the cycle, at the very first histologic manifestation of secretory activity in the endometrium, but this suggestion has not been followed by us in this paper. The menstrual phase, of course, represents the stage of actual menstrual bleeding. The distribution of our cases is indicated in Table I.

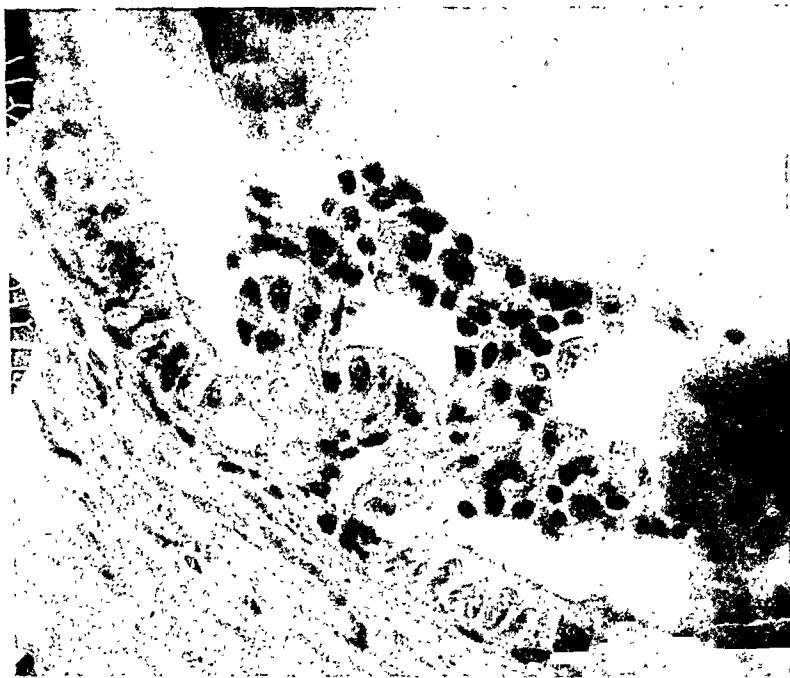


Fig. 11.—Tube of opossum 8 days after ovulation, showing clump of extruded nuclei in lumen, the process being the same as in the human (cf. Fig. 10). For this picture I am indebted to Dr. Carl H. Hartman.

*Postmenstrual Phase.*—In the very early postmenstrual phase, immediately after the cessation of menstruation, the tubal epithelium is still very low, measuring perhaps only 10 to 15 microns in height. (Figs. 1 and 2.) The ciliated cells are still broad and low, but the cilia are clearly discernible. The secretory cells have in part become narrow and cylindrical, but many of them still show round or triangular nuclei at the very border, left naked by the preceding stages. Rather rapidly the height of both ciliated and nonciliated cells increases, so that, at the end of this phase, they may be as much as 25 or even 30 microns in height. “Peg” cells are seen only here and there. (Fig. 1.)

The cells are arranged in different proportions at different portions of the tube wall. In many areas they are fairly evenly divided, although often their distribution is patchy, i.e., short strips made up entirely of ciliated cells alternating with short strips of the nonciliated type. This arrangement, it has seemed to us, is more often seen at the isthmus than elsewhere. (Fig. 5.)

*Interval Phase.*—In this stage the appearance is quite characteristic, so that there is little possibility of mistaking it for any of the others. The chief characteristic, perhaps, is the great height of the cells (often 30 or 35 microns), their uniformity in this respect, the apparent increase of ciliated cells, their increased width, and the prominence of the cilia. (Figs. 6 and 7.) The secretory cells now show an increasing accumulation of cytoplasmic material, so that bud-like herniations of the free border, sometimes incorrectly interpreted as agglutinated cilia, are quite common.

An interesting observation may be noted at this point. In a considerable number of instances in which the endometrium showed a typical late interval picture, we have been surprised to find that the secretory cells in the tube had advanced to a stage of definite secretory change, similar to that which will presently be described as characterizing the premenstrual phase. In other words, the secretory phenomena

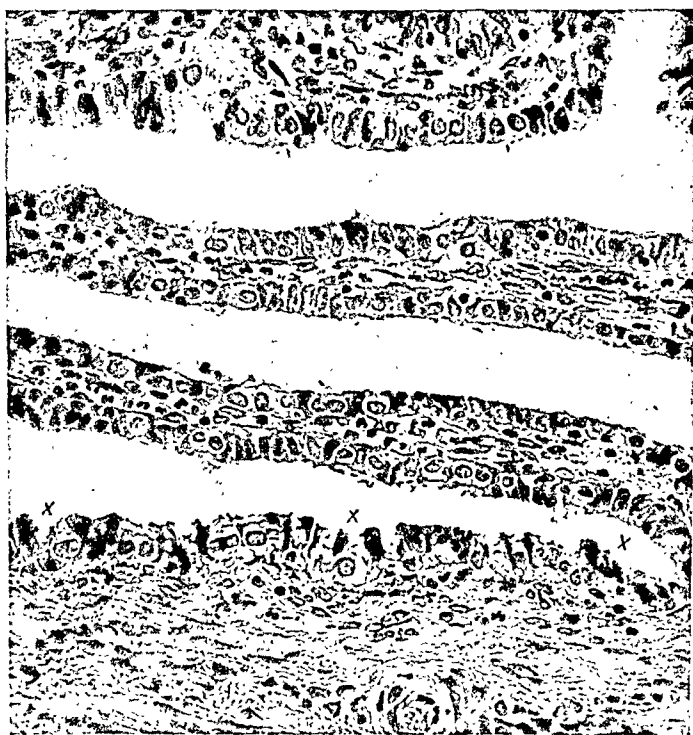


Fig. 12.—Tubal epithelium during menstruation (twenty-four hours after onset). The row of cells indicated at *x* shows persistence of premenstrual picture (cf. Figs. 8 and 10) while in other parts of the lumen the cells have assumed the more typical postmenstrual type, i.e., low and without secretion (cf. Fig. 1). The endometrium of this case is shown in Fig. 13.

appear to pass along the generative canal like a wave, striking the tube first and later passing down into the endometrium. The suggestion natural from this observation was that possibly these curious secretory phenomena were in some way linked up with the passage downward of the ovum, and, to proceed a step further, that perhaps the function of the secretion was to constitute either a protective envelope or a source of nutrition to the migrating ovum.

While this view is possibly correct, the chronology of the events in the sex cycle does not favor it. If the ovum is given off from the follicle at anywhere between the fifth and fifteenth day of the cycle, as most of us now believe, secretory changes in the tube, if of importance to the ovum, should manifest themselves much earlier in the cycle than they do. In other words, when this secretory activity in the tube

is at its height, the ovum has, presumably, long since passed beyond this point. This matter will be more fully discussed below.

*Premenstrual Phase.*—The characteristic premenstrual picture presented by the tubal epithelium can rarely be mistaken. The transition from the interval is not a sharp one, so that, in the early premenstrual period, the epithelium may still be of uniformly great height. Later, however, the epithelium becomes much lower, and especially the ciliated cells, which may now in many places be scarcely more than 15 microns in height. They are still broad and clear-staining, and the cilia are still conspicuous.

More interesting are the changes in the nonciliated cells, which proportionately are much taller than the ciliated, so that their free extremities project for a considerable distance above the latter. (Figs. 8 and 9.) Our study of human material indicates that this disproportion between the two types is rarely so extreme as that pictured by Snyder for the epithelium of the pig's tube, but it is sufficient to give



Fig. 13.—Endometrium from same case as the tube shown in Fig. 12. The entire compacta, and most of the spongiosa, have been thrown off.

the free epithelial border a characteristically irregular or notched outline. The projecting ends of the nonciliated cells are rounded or knob-like, because of an accumulation of cytoplasmic material. In many of the cells the process of extrusion of this material can be seen, and often collections of these cytoplasmic masses, resembling desquamated cells, can be seen in the lumen. Their real nature can be assumed from the fact that in many cells this process is caught, as it were, in actual operation. Not infrequently the nuclei are thrown off with the cytoplasmic masses, this constituting one of the most puzzling features of the whole process. (Figs. 10 and 11.)

In this stage, even more than in the preceding one, a curious cluster-like grouping of the secretory cells is seen, especially, though not exclusively, at the tops of the folds. In these clusters may be seen from four or five to as many as twelve or fifteen of the characteristic dark, rod-like nuclei, spreading out in a fan-like manner from the basement membrane to the free epithelial border. (Fig. 8.)

The cells are so closely crowded together and often show so little cytoplasm that a first glance may give the impression of a large multinucleated cell. The nuclei often overlap so that, in many instances, only sharp focusing will show their distinctness.

*Menstrual Phase.*—With regard to this phase, the chief point of discussion, as stated early in this paper, has been the question of whether or not the tubal mucosa participates in the actual hemorrhage of menstruation. Many studies have been made on this point, the evidence now being quite conclusive that the normal tube plays no active part in the bleeding of menstruation. We shall not discuss this point in this paper, except to say that our studies of tubes removed during menstruation have convinced us that this now generally accepted view is correct. We have found no evidence whatsoever of actual menstrual bleeding from the tubal

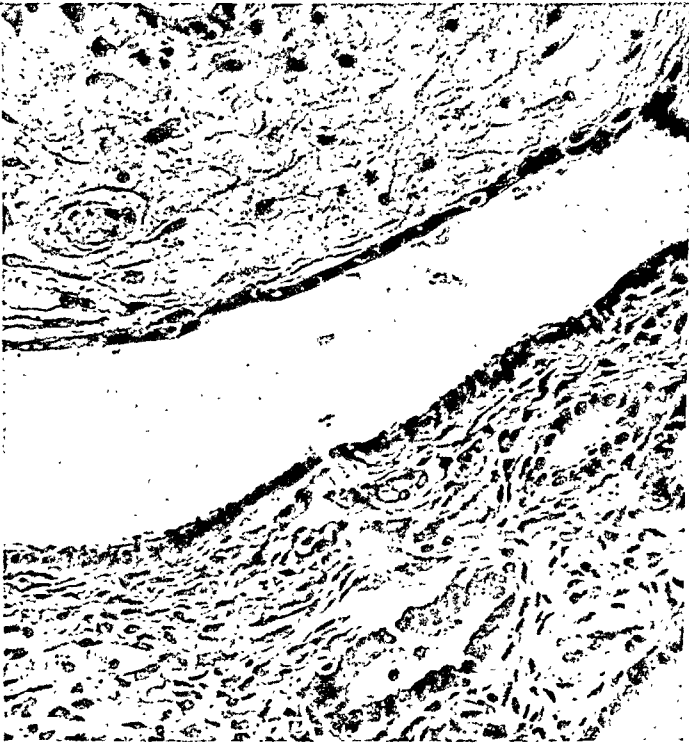


Fig. 14.—Tubal epithelium at about 4 ½ months' pregnancy (uterine). Above is seen a distinct decidual nodule in the tubal wall, a rather infrequent finding. Over it the epithelium is very flat, almost like simple squamous epithelium. This accords with the observation of Voinet (see historical review in text), although, as will be seen, the remainder of the tubal epithelium is also much lower than in the nonpregnant condition.

mucosa, although there is little doubt that the tube, like the other pelvic organs, participates in the general hyperemia which characterizes the menstrual phase, or, perhaps even more, the premenstrual epoch.

Examination of the tubal epithelium at the beginning of menstruation may show a picture essentially similar to that described for the premenstrual stage, except that the epithelium is somewhat lower. This feature becomes much more accentuated later in the process, so that, by the third day, the epithelial cells, of both types, are perhaps only 10 or 15 microns in height. As has already been emphasized, this change is not usually a uniform one, for in some parts of the tubal wall the

epithelium may still be quite high, perhaps as much as 25 microns in height. (Figs. 12 and 13.) The change, however, is always sufficiently extensive to be quite striking.

The ciliated cells are even lower than in the preceding stage, and still fairly broad, with clearly marked cilia. The secretory cells also become much shorter, chiefly from the loss of the large cytoplasmic bulbs so conspicuous in the premenstrual phase. The nuclei are thus left bare of cytoplasm, especially toward the lumen. This gives the epithelium a peculiar stubby appearance which is rather characteristic.

"Peg" cells are still quite numerous. This is not surprising if one holds the view that they represent emptied secretory cells, or even if one considers them degenerated nonciliated cells.

*Pregnancy Changes.*—Only the changes of early pregnancy will be discussed, as the material of our laboratory has given us little opportunity to study those of late pregnancy. The pregnancy changes in the tube bear somewhat the same rela-

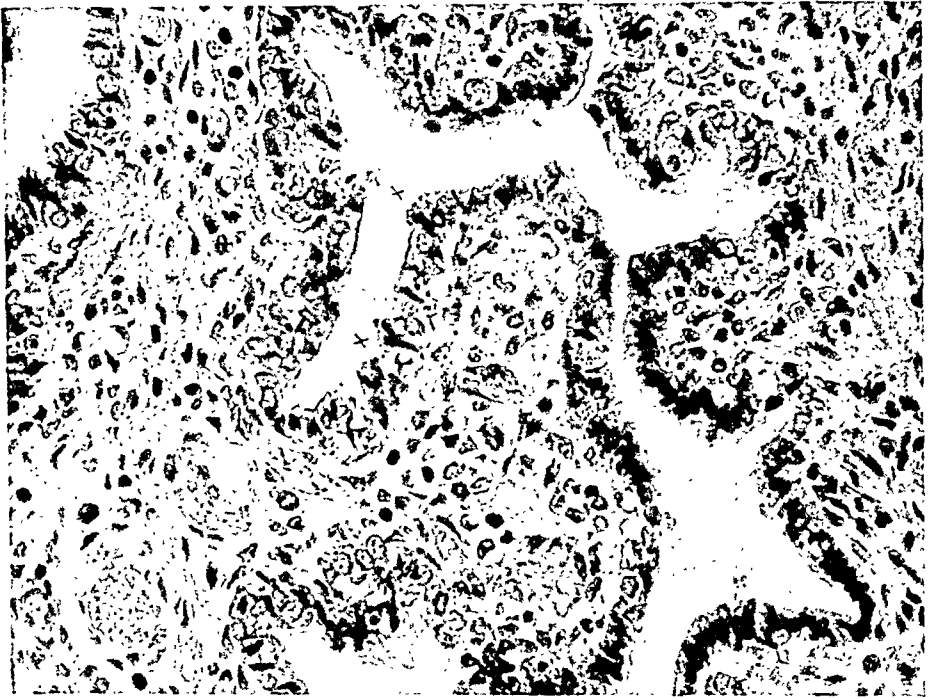


FIG. 15.—Epithelium of tube from infant born prematurely at 6 ½ months, and dying one month later. Both types of cells are clearly seen; especially at  $\times$ . A few cilia are also seen, though imperfectly, in the same region.

tion to those of the premenstrual stage as do the changes of the corresponding phases in the endometrium, or in the corpus luteum. The tubal epithelium, low in the premenstrual period, becomes lower in case pregnancy supervenes. (Fig. 14.) The ciliated cells become extremely low, but still retain their cilia. The non-ciliated cells are also of short stature, of fairly regular outline, rather uniform size, and often show a slight convexity of the free border. Their appearance, however, is quite different from that of the premenstrual period, in which the cytoplasm appears to be actually bursting through the cell membrane into the lumen. In the gravid phase there is only a gentle rounding of the free end, often giving the epithelial border a finely wavy outline.

As further evidence of the similarity of reaction of the endometrium and endosalpinx to the pregnancy stimulus, we may add that, in cases of tubal pregnancy in which the death of the embryo has obviously occurred a considerable time



before operation, the tubal mucosa will no longer show the characteristics of the gravid phase, but will revert back to a quiescent postmenstrual or interval picture. This is equally true of the endometrium, which characteristically presents a similar quiescent picture, rather than that of decidua, in the usual cases of tubal pregnancy, where bleeding has been present for perhaps many weeks because of early destruction of the ovum.

#### RELATION BETWEEN THE CILIATED AND NONCILIATED CELLS

As will appear from the historic survey embodied in this paper, many authors have interested themselves in the possible relationship between the two chief types of cells. A considerable number have



Fig. 16.—Tubal epithelium showing typical senile change. The patient was sixty-three years old. The epithelium at the lower part of the section is still remarkably tall, while that above has become quite flat, with a disappearance of cilia. The latter, however, may persist for many years after the menopause. Note also the rounding of the tubal folds.

supported the view that the secretory cells are merely modified ciliated cells (Nicolas, Voinot, Schaffer, etc.). The chief ground for this belief is the demonstration of what have been interpreted as transition stages between the two types. Our own feeling is that most of these supposed transition pictures are really only stages in the life history of the nonciliated cells, which are notoriously polymorphous.

It is difficult to see how a mere absence or apparent degeneration of cilia can be considered of much import as indicating a beginning transformation of ciliated into the nonciliated cell, when one con-

siders the frequency with which, in the ordinary fixed section, one notes these features in cells which, from a morphologic standpoint, are obviously of the ciliated type. If the studies of Moreaux upon the finer structure of the cells could be substantiated in the human, the evidence for this interchangeability of type would be quite convincing. So far as we know this has not yet been done.

Our own studies have led us to believe that there is some change in the proportion of the cells at different phases. For example, in the interval stage, the ciliated cells appear to outnumber the secretory, while the reverse appears to be true during the premenstrual phase. This variation, however, is rarely very striking, nor can it be con-

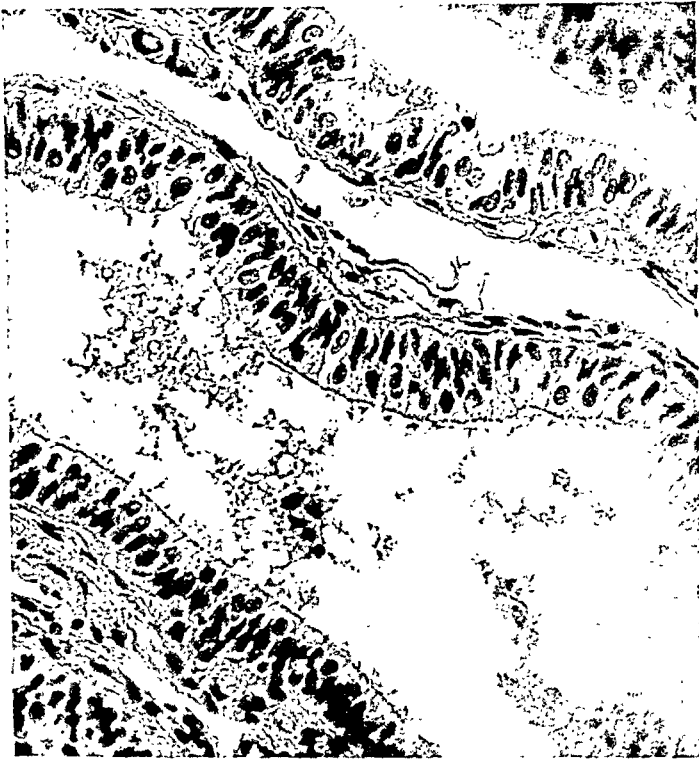


Fig. 17.—Tubal epithelium from a case of hyperplasia of the endometrium, with functional uterine bleeding. The ciliated cells predominate, and although the other type is seen, there is not the slightest sign of secretory activity. The epithelium is very tall, narrow, and compact. It appears to be a result of the persistence and continued growth of the interval mucosa, as would be expected from the etiology of the condition. The endometrium from this case is seen in Fig. 18.

sidered as evidence that one type is transformed into the other. Moreover, the indisputable fact remains that both types are found at all stages in fairly even proportion, and that this applies also to tubes before puberty and long after the menopause, when one can scarcely assume such a physiologic stimulus for cell variation as exists during the reproductive epoch. We are, therefore, inclined to the belief that the two types of cells are separate and distinct, although the problem must still be considered an unsettled one.

## NATURE AND SIGNIFICANCE OF THE TUBAL "SECRETION"

This problem also has been discussed by a considerable number of those who have studied the tubal epithelium, although it is evident that the ideas expressed have, as a rule, been based upon speculative rather than scientific grounds. The views of a number of investigators on this point have been stated in the historical résumé which we have presented, so that they need not be again set forth (Mandl, Linari, Schaffer, Holzbach, Moreaux, Tröscher, etc.). Only an occasional writer, like Gurwitsch, appears to question that the nonciliated cells are actually secretory in function.



Fig. 18.—Typical hyperplasia of the endometrium, with the characteristic Swiss-cheese pattern of the glands. The patient suffered with functional menopausal bleeding. Compare with Fig. 17, which shows the tube from the same case.

And yet, when one analyzes the evidence, there is as yet no definite proof for such a function, except that of cell morphology, which is notoriously unreliable as an index of cell physiology. A number of investigators have attempted to study the question by differential staining methods, but the results have been practically negative. We ourselves have stained a considerable number of tubes with mucicarmin and thionin in an effort to demonstrate mucin, with negative results. We have also stained a considerable group with Best's stain, but have found no evidence of glycogen. Other workers (Tröscher, Jacovlev, Schaffer, etc.) have been equally unsuccessful.

This is in striking contrast with the demonstration in the premenstrual endometrium of both glycogen and mucin, with possibly a third substance of protein nature (Aschheim). This observation we have repeatedly confirmed. The uterine glands, therefore, are with much reason looked upon as the source of a secretion ("uterine milk") which is probably of importance to the ovum after it has reached the uterine cavity, and before it has implanted itself in the endometrium.

On teleologic grounds, the natural assumption would be that the tubal secretion, if it exists, is of importance to the ovum during its passage through the oviduct. We have, however, already referred to the fact that the height of the secretory activity is reached long after the ovum has passed through the tube, if the generally accepted views on this point are correct. On the other hand, it must be borne in mind that any secretion given off by the tubal epithelium would not long remain at the point of its discharge, for the vigorous propulsion of the cilia would carry it rapidly down the tube to the ovum, wherever it may be.

Here again attention may be called to the studies of Moreaux upon the rabbit's tube. This investigator found that if the egg is examined shortly after coitus, when still in the fimbriated end of the tube, it is bounded externally by the zona pellucida. If, however, the examination be made three days after coitus, when the ovum is near the uterus, it is found to be surrounded by a mucinous envelope which he designates as the "membrana zonale." That such a gelatinous capsule, whether protective or nutritional, actually exists in the rabbit we have been able to see for ourselves through the kindness of Dr. George L. Streeter, director of the Carnegie Institute of Embryology.

Schaffer likewise states that in rabbits and some other rodents the secretory cells show a coarsely granular prosecretion, which exhibits the characteristics of mucin. He quotes Ellermann as having demonstrated that in certain lower forms (amphibians) typical mucous cells are to be found scattered among the ciliated cells.

For such reasons as this there is much reason to believe that the nonciliated cells actually contribute a substance of some importance to the protection or nutrition of the ovum, in spite of the negative results which have thus far followed efforts to determine the nature of this substance. That cytoplasmic material in considerable amount is given off into the lumen cannot be doubted, and it would seem unbelievable that this process serves no useful purpose. The only other explanation one can think of is that the process is purely a degenerative one, and that it represents a cyclical cellular destruction perhaps comparable to the more massive and more easily demonstrable monthly desquamation of the endometrium.

With no evidence at all to bear on the point, it does not seem impossible to us that this peculiar cellular "secretion" of the tube, some

of which may readily enter the peritoneal cavity, may in some way be related with the etiology of endometriosis. There is much difference of opinion as to the correctness of the menstrual regurgitation theory of the causation of endometriosis, but the fact that the tubes are commonly patent lends much weight to the view that, whatever the cause may be, an important factor must be some substance derived from these open tubes. We are inclined to think that there is more plausibility in the view that the substance is derived from the tube itself than that it is regurgitated from the uterus.

The stimulus for the "secretory" activity of the nonciliated cells cannot be definitely stated. Like the corresponding phase in the uterine epithelium, the secretory stage in the endometrium begins just after ovulation, and advances synchronously with the development of the corpus luteum. It is probable, therefore, that the latter structure is responsible for this peculiar cell activity. Additional evidence for this belief lies in the fact that secretory changes in the tubal epithelium of such animals as the rat do not appear until the metestrus, after the rupture of the follicle and the formation of the corpus luteum. Finally, as we shall stress in a later paragraph, the tubal epithelium associated with hyperplasia of the endometrium, in which condition corpora lutea are absent in the ovary, is characterized by an absence of secretory phenomena and a predominance of the ciliated cells.

*The Tubal Epithelium in Early Life.*—Being interested primarily in the cyclical changes in the adult tube, we have not studied the tubal epithelium in early life very intensively. On the basis of the few observations we have made, however, it may be said that the tubal epithelium of the newborn infant presents no very striking changes from that of the adult, other than an absence of cyclical change. The epithelial cells are somewhat lower, both the ciliated and the nonciliated. (Fig. 15.) The two types are clearly discernible, in spite of the fact that only a few of the cells which, from their morphology and distribution, are destined to become the ciliated cells, possess cilia at this period of life. This sparseness of cilia, according to Voinot, persists up to the time of puberty. In the tubal epithelium of a fetus of seven months we were able to find no cilia whatever, an observation which corresponds with that of Voinot on this point.

*The Tubal Epithelium of Senility.*—Perhaps the most surprising feature of the postmenopausal picture in the tubal epithelium is the fact that for a long time, perhaps several years, after the cessation of the menstrual cycle, there is little or no evidence of atrophic changes in the epithelium. The cells remain high, both types persisting, so that the picture is not unlike that seen in the interval phase of younger women. (Fig. 16.) The cilia are abundant, although there is no indication of

active secretory change in the nonciliated cells. In other words, the whole picture suggests that the growth stimulus due to the follicle hormone persists long after ovulation and corpus luteum formation have ceased. This, after all, is just what one would expect, for long after corpora lutea have disappeared from the ovaries, atretic follicles may be found in considerable number, presumably containing a certain amount of active follicle hormone, which exerts a growth-producing effect upon the tubal epithelium.

The persistence of cilia long after the menopause, like their appearance long before puberty, would indicate that they must have some function other than their supposed rôle in facilitating the passage of the ovum through the tube. This fact has already been discussed in a preceding paragraph.

Conspicuous atrophic changes are not seen except in the tubes of women of sixty or over. Cilia, for that matter, may be found even beyond this age. The tubal folds become more or less rounded, and the epithelium of cuboidal type, or even quite flattened. (Fig. 16.) As in other phases, these changes differ in degree in different parts of the tubal wall, so that in some parts of one section the epithelium may be fairly tall, in others quite flat, like simple squamous epithelium. In the flattened areas, of course, there is no trace of cilia, nor is it usually possible to distinguish the two chief types of cells.

*The Tubal Epithelium in Cases of Hyperplasia of the Endometrium.*—In view of the fact that hyperplasia of the endometrium, associated clinically with so-called functional uterine bleeding, is unquestionably due to a disturbance of the ovarian secretion, and that the endometrial response to this disturbance is a very characteristic one, it has seemed to us worth while studying the reaction to it of the segment of müllerian tissue comprised by the tube. Our material for this investigation is necessarily quite small, for it is only rarely nowadays that such cases come to abdominal operation.

The functional disorder in these cases is quite generally accepted as consisting of an absence of corpora lutea and an excess or persistence of the follicular stimulus. For details as to this point we may refer to the complete review of the subject by Novak and Martzloff in 1924. From what we have already said as to the physiologic response of the two chief types of tubal cells to the follicle and corpus luteum, one would expect to find, in cases of hyperplasia of the endometrium, a predominance of ciliated cells, with a subordination or absence of secretory activity on the part of the nonciliated cells. This is exactly what seems to occur, as will be evident from Fig. 17. The epithelium in general is tall and rather narrow, cilia are extremely abundant and well marked, while the nonciliated cells, though clearly differentiated, show no sign of secretory activity. (Figs. 17 and 18.) They often seem to show a genuine decrease in number, though this may be only

apparent because of the marked development of the ciliated cells. At any rate the picture is a very characteristic one. We have never in a case of hyperplasia of the endometrium seen any suggestion of marked secretory activity, nor do we believe that such a picture occurs in the tube, any more than it does in the endometrium.

#### SUMMARY

While the tubal mucosa does not participate in the bleeding of the menstrual process, its epithelium exhibits a definite cyclical change comparable with that of the endometrium. It is, however, not nearly so conspicuous as the latter, being concerned more with microscopic changes in the cells rather than with the grosser changes in pattern seen in the endometrium. The present study, based upon the careful examination of the tubes, from 136 cases, in almost all of which the endometrium was also available for study, has demonstrated the following chief facts:

1. The tubal epithelium consists of two chief types of cells, the ciliated and the nonciliated. The latter are often spoken of as "secretory" cells. A third type, the "peg" cells ("Stiftchenzellen," "Schaltzellen") are also described, but it is probable that these represent only a phase of the nonciliated cells.

2. In the interval phase, the epithelium is uniformly tall, the ciliated cells being broad, with rounded nuclei near the free margin, while the nonciliated cells are rather narrower, the nuclei being more deeply placed and taking a deeper stain.

3. In the premenstrual phase the ciliated cells become lower, so that the "secretory" cells project beyond them, giving the epithelial margin a ragged, uneven appearance. The "secretory" cells show a bulbous herniation into the lumen of the tube, often carrying the nucleus with it. This extrusion of nuclei is similar to that seen in many lower animals, but its significance is not known. In spite of the great loss of cells, mitoses are rarely seen in the tubal epithelium.

4. During the stage of menstruation, the premenstrual changes are carried further, the epithelium becoming quite low. The ciliated cells, especially, remain broad and low, but the secretory cells also, having been emptied of their cytoplasm, are much lessened in height, the nuclei often being quite bare of cytoplasm. "Peg" cells are numerous, their appearance and distribution suggesting that they are merely emptied "secretory" cells.

5. The postmenstrual phase is characterized first by a low epithelium, which quite rapidly, however, increases in height, so that by the third or fourth day after menstruation it is often almost as tall as during the interval phase. The cells are narrow, closely placed, and, after the first day or so, of uniform height.

6. During pregnancy, the epithelium becomes even lower than in the menstrual stage, and in the later stages it may become almost flat in many places. Secretory changes are not seen at this time.

7. Cilia can be demonstrated in all stages, especially through the examination of fresh tissues, by the technic described in the paper. They are also found in the tubal epithelium of young children and in women many years beyond the menopause. This suggests that they must have some other function than that of assisting in the propulsion of the ovum. Perhaps, as has been suggested by Hartman, their chief rôle may be that of keeping the tubal lumen cleansed of foreign particles of any kind.

8. Efforts at differential staining of the secretion have thus far been unsuccessful. Neither glycogen nor mucin can be demonstrated, unlike the findings in the secreting endometrium. The various views as to the significance of this tubal secretion are discussed in the paper, although there is as yet no positive knowledge as to this point.

9. The prepuberal tubal epithelium is rather low, but shows both chief types of cells. Cilia, however, are very sparse, and are usually not seen at all in fetal or very early postnatal life.

10. The epithelium of the postmenopausal tube may remain quite high for a surprisingly long time, perhaps a number of years after the cessation of menstruation. Cilia, likewise, may persist for many years. Sooner or later, however, the tubal folds become rounded, of fibrous appearance, the epithelium becomes low or even quite flat, and cilia, of course, disappear.

11. The tubal epithelium of tubes removed from patients suffering with hyperplasia of the endometrium was studied because the latter condition is unquestionably associated with a functional disturbance of the ovaries. Characteristically the epithelium was found to be high, uniform, compact, with narrow cells, most of which were ciliated. There was no evidence of secretory change. This bears out the view, for which there is other evidence, that the functional disturbance consists of an excess or persistence of the follicle stimulus, with an absence of the corpus luteum influence.

12. The comparison of the tubal cycle in women with that of the lower animals, like the comparative study of the uterine and ovarian cycles, emphasizes the important differences, chronologic and histologic, which exist. For example, the estrus tube of the rodent resembles, not the menstrual or premenstrual tube of the human, but the interval phase. Since estrus in the lower type is undoubtedly due to the follicle hormone, it seems clear that in the human the maximum of follicle influence is reached during the interval phase, and that the later changes are due to the corpus luteum influence.



To bear this out, the picture in the animal tube which resembles the human premenstrual tube is that seen in the metoestrus, during which stage the corpus luteum apparently plays the dominating rôle.

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# GONOCOCCAL LESIONS OF THE FEMALE GENITALIA, INCLUDING CONSIDERATION OF SOME IMPORTANT CLOSELY ALLIED PROBLEMS\*

By ARTHUR H. CURTIS, M.D., CHICAGO, ILL.

WORK in the laboratory has not added materially to my knowledge of pelvic infections since an address on this subject† one year ago. None the less, I am impelled to emphasize, in summary, certain views which have perhaps not aroused the interest which their importance merits.

## I. PRINCIPLES UNDERLYING RECOVERY FROM INFECTIONS

*Rest, drainage through natural channels and prevention of reinfection* are the cardinal factors in the cure of all bacterial diseases not amenable to specific therapy. The value of excision of tissues for the purpose of eradication of infection has been greatly overstressed. Although sometimes essential, operation for removal of infection is too often resorted to as a routine procedure; correction of pathologic changes resultant from infection is a much more frequent indication for surgical intervention.

These statements are peculiarly applicable to gonococcal infections of the female genitalia.

## II. PERSISTENCE OF GONOCOCCAL INFECTIONS OF THE LOWER GENITAL TRACT

Roughly expressed, gonococci tend to disappear from the tissues with a rapidity in inverse ratio to their distance from the vulva; external gonococcal infections are the most stubbornly persistent.

Whether infections of the urethra, Skene's ducts and the cervix persist because of anatomic peculiarities (including relatively poor drainage), or whether greater exposure to traumatism and to reinfection are responsible for the long-continued presence of gonococci in these tissues, is not yet a closed issue. Prolonged observation of an extensive series of women with unyielding infections has impressed me with the important rôle played by fresh reinfection in the maintenance of chronic gonorrhea of the urethra and of the cervix. Such evidence as is at present available indicates that every patient whose infection is resistant to treatment should be urged to avoid unprotected contact even though her sexual companion is apparently free from venereal disease.

\*This paper was a part of a symposium on pelvic infection in addition to the papers by Drs. Watson, Gellhorn, and Norris, which follow. Another paper of this group, that by Dr. F. C. Holden, on "Cervicitis," together with the discussion on the series, will appear in the November issue of the Journal.

†Jour. Am. Med. Assn., 1927, lxxxiv, 1191.

Of all foci which harbor the gonococcus, infections in abscess pockets of Skene's ducts are perhaps the most persistent. The gonococcus also remains continuously viable in the deep urethral wall in those patients who have been subjected to intensive or traumatic treatments during the active course of the disease. Forceful treatments of the urethra, not only during the height of gonorrheal infection, but also during the descending wave of its activity, should be stamped with our unqualified disapproval.

Combined laboratory study and clinical experience formerly led me to the deduction that gonorrheal infections of the cervix are particu-

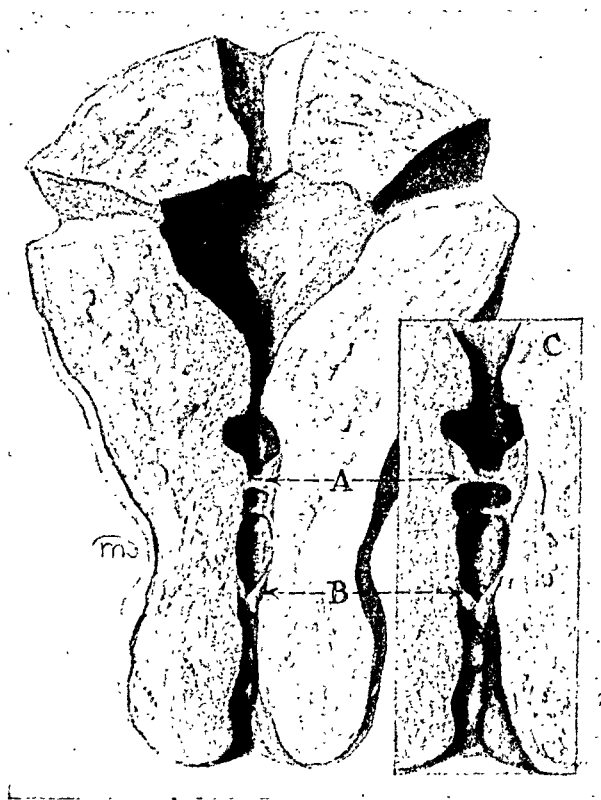


Fig. 1.—Cervical stricture. Patient aged fifty-four (menopause at forty-eight years). Purulent leucorrhea for one month prior to operation; no history of previous infection or instrumentation. *A*, Cicatricial bands with retention of purulent material above. *B*, Complete stricture impassable to dilator. *C*, Cervix spread open.

larly persistent. This belief appears to require some modification; consort reinfection accounts for more of these cases than was evident in my earlier experience, and gram-negative diplococci other than the gonococcus have gradually been found to occupy a somewhat more important rôle in the bacteriology of chronic cervicitis.

### III. CERVICAL DRAINAGE

When we, as specialists, awaken to a full realization of the frequency and importance of cervical strictures, a great step forward will have been accomplished. Radium, the electric cautery, plastic

procedures upon the cervix, the Sturmdorf operation—even though resorted to with faultless technic—all contribute their quota of cervix obstructions. Office treatment for leucorrhea, dilation and curettage, gonococcal infections of the cervix whether treated or untreated, predispose to partial or complete stricture of the cervical canal in later years, notably after the menopause.

The otherwise inexplicable sudden appearance of leucorrhea after the climacterium is pathognomonic evidence of leakage of pent-up secretion through an unnatural cervical barrier. A case of this character is shown in the accompanying illustration (Fig. 1). This uterus was removed three weeks ago from a patient, aged fifty-four, six years after the menopause. Contrary to the usual rule there was no history of gonorrheal infection, abortion, local treatment, or operative manipulation.

Two other cases of complete stricture have been encountered within the last six weeks.

Obstructions of the cervical canal need not be complete; even though partial they are often sufficient to interfere materially with drainage. Sometimes the obstruction is friable, but relatively firm cicatrices are the rule. With the exception of the external os, the lower half of the cervical canal is less often involved.

Microscopic pockets in the wall of the endocervix may also be sufficient to prevent adequate drainage, even though there be no gross obstruction of the cervical canal. It is my experience that most patients with uncontrollable purulent leucorrhea of otherwise inexplicable etiology have lesions of this character. The electric cautery knife is particularly efficient in this type of case.

Emphasis of cervical strictures and microscopic endocervical pockets, which account for chronic leucorrhea through interference with drainage, is not intended to discount the importance of other causes of chronic leucorrhea. Easily demonstrable lacerations and repeated reinfections are outstanding factors in the etiology of intractable chronic cervicitis; pelvic congestion and specific parasitic infections also account for a considerable number of cases.

#### IV. "THICKENING" OF SKENE'S DUCTS; BARTHOLIN GLAND ENLARGEMENTS

Investigation of appropriately selected patients, subjected to correlated pelvic examination and painstaking study of their histories and the histories of their sexual companions, has convinced me that thickened Skene's ducts are pathognomonic of gonococcal infection. But we must recognize that many patients have "thick" ducts—thick by nature or acquired as a result of traumatism—which are rigid on palpation but are devoid of specific inflammatory reaction. There are many of these cases in which I find it impossible to deduce, without other evidence, whether Skene's ducts are "thick" or "thickened."

Enlarged Bartholin glands, in contrast with thickened Skene's ducts, are not always pathognomonic of gonococcal infection. Traumatism, injuries of childbirth and plastic operations account for many cases. *Bilateral* Bartholin gland enlargement is diagnostic of gonorrheal disease although, theoretically, injury might also involve both glands.

#### V. GONOCOCCAL INFECTIONS OF THE TUBES; INDICATIONS FOR OPERATION

Since 1921 we have almost discontinued operations for the purpose of eradication of tubal infections. In consequence I have little to add to my work on the bacteriology of relatively active tubal inflammations. Continued study of inactive tubal inflammations fails to reveal gonococci or "mixed" infections in cultures of thoroughly ground tubes; this experience is at variance with the belief of some authorities who assume that organisms associated with the gonococcus are frequently present and remain persistently viable. An occasional exception is a persistent tubo-ovarian abscess infection in patients free from suspicion of fresh reinfection; as a rule these are "mixed" infections.

In essential features further laboratory study and added clinical experience have confirmed earlier deductions: gonorrheal salpingitis is essentially a self-limited process; persistently active gonorrhea of the tubes is ascribable to recurrent infection rather than to chronic infection; with reinfection prevented the tubes heal spontaneously.

Eighty-five per cent of patients who come to us with acute salpingitis progress to a clinical cure without operation. Surgery is ultimately resorted to in approximately fifteen per cent of these cases, chiefly for relief from the sequelae of salpingitis; operations are directed to the reconstruction of tissues laid waste by disease rather than to removal of organs for the purpose of stamping out infection. The chief indications for intervention are:

1. Painful displacement of the uterus.
2. Adhesions with symptoms.
3. Uterine bleeding due to disturbed function of the ovaries.
4. Giant hydrosalpinx or tubo-ovarian cysts.
5. Rare cases of persistent tubo-ovarian abscess.
6. Unusual patients who, despite warning, repeatedly subject themselves to fresh tubal infection.
7. Selected sterility cases. Operation solely for relief of sterility is occasionally undertaken but is limited chiefly to those in whom the adnexa are not palpably enlarged.

#### VI. NOTES ON OPERATIVE TECHNIC

Widely accepted principles in operative technic merit casual mention: A portion of the body of the uterus should be removed at the time of salpingectomy if sterility is inevitable. Complete hysterectomy is indicated if the cervix is notably diseased. Suture of the ligaments into the uterine stump is not vitally important but is help-

ful if it can be done without producing undue tension or distortion. Removal of the appendix is perhaps best limited to those cases in which it is diseased or predisposed to future trouble. Routine gentle palpation of the contents of the entire abdominal cavity is advisable.

*Disposition of ovaries at the time of operation; healed tubes encountered during hysterectomy.*—As stated elsewhere, a decision relative to the disposition of a doubtful ovary requires most careful consideration of the etiology of the pelvic infection. If of gonorrheal origin, preservation of the ovaries appears desirable unless they are rather badly crippled or the circulation is impaired. If one ovary must be sacrificed it is inadvisable to resect a major portion of the remaining one; complete removal is preferable. Healthy prolapsed ovaries should be replaced into normal position. Operative displacement of the ovaries into the midline or suturing them to the uterine stump is objectionable. Sutures introduced into the ovarian substance invite trouble; cautery puncture of follicular cysts is also inadvisable because it predisposes to adhesions.

A healed tube which produces no symptoms does not necessarily require removal in patients subjected to hysterectomy; for three years we have made a practice of leaving undisturbed those smoothly healed tubes (including slight hydrosalpinx) which produce no symptoms and cannot be removed with the uterus without injury to the ovary or its circulation. My tendency is to spare an increasingly larger percentage of such tubes; this insures the function of the ovary and permits a simpler and neater pelvic toilet.

#### VII. QUESTIONS

In closing, I wish to present some queries for discussion at this time:

1. My experience indicates that, if one ovary must be sacrificed, resection of a major portion of the remaining one is frequently followed by interminable persistence of flushes and other menopause symptoms. In view of this evidence, are we justified in hoping for satisfactory results following transplantation of pieces of ovary?

2. Healed ovaries may be firmly imbedded in adhesions. In the absence of notable symptoms is it good surgery to leave such ovaries undisturbed at the time of operation?

3. Within two years at least three of my private patients have developed definite pelvic cellulitis subsequent to cautery treatment of the endocervix (fortunately all recovered relatively promptly). This complication is perhaps more common in those who have a retrodisplacement of the uterus. I have wondered whether others find that a single cautery knife treatment is always a harmless procedure.

## POSTPARTUM PELVIC INFECTIONS

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THE part assigned to me in this symposium is puerperal infection or infection occurring after full-time labor. It is obviously impossible to deal adequately with all parts of this subject in the time at my disposal and I shall, therefore, limit myself to a consideration of certain phases of the problem such as the source of the pathogenic organisms and their mode of entry to the genital tract in the parturient or puerperal woman, the mode of growth and dissemination of these organisms in such cases in contrast with their behavior in non-parturient cases and finally the end-results.

The more the subject of puerperal infection is studied the more complicated does it become. That sepsis has been practically eliminated from surgical practice and that its incidence in obstetric practice throughout the countries of the world has diminished so little has been held as a reproach to our profession. This reproach is deserved to the extent that it must be conceded that in the majority of cases in which septic infection occurs there has been some breach in technic or some error in judgment in the conduct of the case. In so far as this is true one must continue to teach that puerperal sepsis is a preventable disease. At the same time, without in any way trying to shirk our responsibilities as a profession or as individuals, it must be recognized that septic infection may occur in cases which have been handled with the greatest care and good judgment. I am led to dwell on this aspect of the subject because of the work done in recent years on the bacteriology of the genital tract, on the epidemiology of streptococcal diseases in general, and because of certain facts which emerged in a series of cases which occurred recently in the Sloane Hospital for Women, New York.

### MODE OF ACCESS OF ORGANISMS TO GENITAL CANAL

It seems to have been proved beyond doubt that a considerable number of pregnant women harbor in their vaginas and cervixes organisms which in their morphology and cultural characters are identical with those which under other circumstances cause infection. Of these the streptococci are the most important group. Dr. Jessie Lees working in my Department in Edinburgh investigated a series of nonpregnant women and found that 45 per cent of these who had deficient pelvic floors and 20 per cent of nulliparae had streptococci

in the cervical canal. In seventy pregnant women only eight yielded sterile cultures from the cervix. In the others staphylococci, diphtheroid bacilli, and streptococci were found. In eleven of the cases, i.e., in 16 per cent, streptococci were present. These results are in general accord with those obtained by other investigators such as Fromme 16 per cent; Bumm and Sigwart 69 per cent; Doederlein 4 per cent; Walthard 27 per cent. Burt White and Armstrong assert that while various strains of streptococci including hemolytic varieties may be normal habitants of the vagina and cervix the streptococcus pyogenes is not. They state that "a hemolytic streptococcus is not necessarily identical with the streptococcus of puerperal sepsis unless proved virulent for laboratory animals." \* \* \* "The significance of the presence of hemolytic streptococci in the cervical canal cannot be studied apart from the question of individual susceptibility." They show that while finding streptococci in the cervix of 35.9 per cent of pregnant women, in only one was the organism a true *Streptococcus pyogenes*. The patient in whom it was found had a normal puerperium.

There can be no doubt, therefore, that streptococci do occur in the vaginas of apparently healthy women. But the vast majority of these women escape any serious infection, from which we must conclude either that these organisms, even the hemolytic ones, are nonpathogenic or that the individual in whom they are found has become immunized against them. This possibility of a patient being immune to the organisms present in her vagina and the presumption that these are of the same type as those of her environment may account for the known fact that the dirtiest patient may be confined in her own home amid the most squalid surroundings with an entire absence of aseptic precaution and have a perfectly normal puerperium. Take her out of that environment and conduct the labor in the same casual way and she will, almost certainly, become septic.

But there is also the possibility that these organisms are potentially virulent and that given suitable conditions, such as bruised, lacerated, and devitalized tissues they may cause infection. There is the further possibility that even in the absence of the last named conditions, certain unknown cyclical changes inherent in the organisms themselves or determined by climatic, seasonal, and other environmental conditions may render them virulent. That members of the group of organisms known as streptococci have periodic waves of virulence is now a well-established fact, minor seasonal waves and major waves occurring in certain years. The accompanying graph, constructed by Mr. Norman P. Pleshette, one of our fourth year students, shows the seasonal incidence of deaths from puerperal sepsis during the past ten years in New York City. That outbreaks of puerperal sepsis are often coincident with an increased incidence of other streptococcal



infections has been frequently noted. (Watson, Dafoe.) This does not argue that these cases of puerperal sepsis occurring at such a time are necessarily or probably cases of autoinfection from vaginal streptococci. On the other hand Dr. Meleney came to the conclusion from the investigation of a streptococcal epidemic in the Sloane Hospital occurring at a time when other streptococcal infections were prevalent in the city that the type of organism was so constant in the different patients that it must have come from a common source and must have got into the genital canal immediately before, during, or after labor.

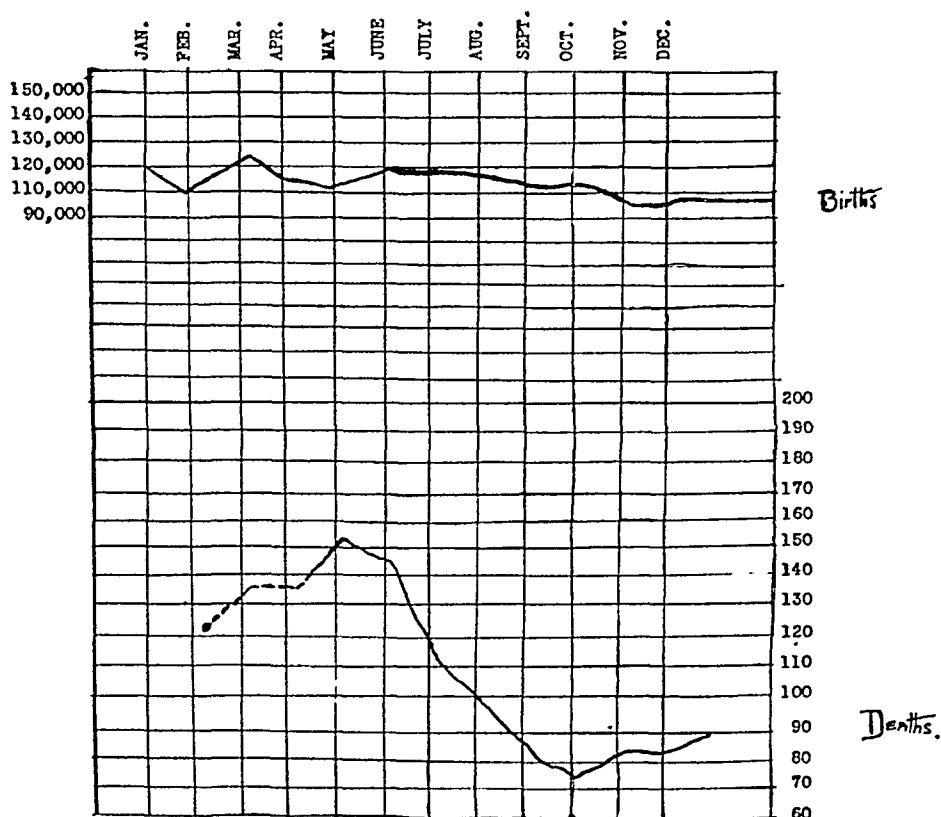


Fig. 1.—A comparison of the monthly birth rate with the corresponding death rate from puerperal sepsis, per 100,000 living and stillbirths, in New York City for the last ten years.

Not only do many women have streptococci and other organisms in the vagina and cervix prior to labor but practically every puerperal uterus contains organisms of various kinds by the third or fourth day of the puerperium (Natvig, Wegelius, Loeser). That the bacterial invasion may occur during labor has been shown by Harris and Browne who have demonstrated bacteria in the uterus in a large percentage of cases of cesarean sections performed more than four hours after the onset of labor. In some of these the membranes were unruptured and in some no vaginal examination had been made. It is thus evident that an absolutely aseptic field is impossible of attainment in

obstetrics and that the most we can hope to do is to prevent the entrance of alien organisms to the genital canal. The improvement in the morbidity rate reported by those who are using mercurchrome as a routine in the preparation of their patients may indicate that it has been found an efficient agent for the destruction of both indigenous and alien organisms.

There seems to be no question that it is the alien and not the indigenous streptococcus which causes the vast majority of cases of serious puerperal infection. Its access to the genital canal may occur insidiously in cases where apparently every ordinary precaution has been observed. Attention will be called to one or two possibilities not yet generally recognized by the practitioner in the hope that if endorsed by this Society attention may be more generally called to them.

The first is the possibility of direct infection of the cervix and uterus from mismanagement of the third stage of labor. In cases where forcible attempts at expulsion of the placenta are made in such a way as to push the uterus down in the pelvis and make the cervix actually protrude at the vulva there is a grave danger of infection. On the release of the organ, material from the lower end of the vagina and vulva may be sucked up. The third stage is possibly the time above all others when infection is most likely to occur as it is a time when the tension on the operator is over and carelessness may easily creep in.

Then we must recognize the possibility of infection occurring in the early puerperium and one of the possible sources is the vulvar pad. Many of us have for this reason discarded the pad altogether, simply having the patient lie on a sterile square of aseptic absorbent covered with gauze.

With the carrying out of ordinary surgical cleansing of the hands and the use of sterile rubber gloves, there should be little risk of direct inoculation of organisms into wounds, but when worn for some time such gloves may become contaminated by fine spray from the nose or mouth of the operator. The nose and throat of healthy individuals in contact with cases of streptococcal infection very often contain the organisms. In our recent experience at Sloane Hospital, where we had twenty-five cases of streptococcal puerperal infection with nine deaths, the only situation in which we found the streptococci, other than in the infected patients, was in the nose and throat of certain members of the medical and nursing staff. Cultures from beds and bedding, pads, dressings, instruments, gloves, walls, floors, and air of wards and operating room were uniformly negative. We, therefore, came to the conclusion that the organism was being incubated in and disseminated from the noses and throats of these individuals. Hence, the importance of excluding all such carriers from contact with pa-

tients and of thorough masking of both mouth and nose by all in attendance on a woman in any stage of labor and in the early puerperium. A patient is probably more jeopardized by a carrier during and after the third stage than at any other time. In looking for and in repairing lacerations the operator is liable to infect his patient unless properly masked.

One other incident in the Sloane epidemic gives food for thought, viz., the occurrence of a generalized primary hemolytic streptococcal peritonitis in a nurse in attendance on one of the infected patients. The organism recovered from her peritoneal fluid was of the same type as that of the majority of our infected cases. How did that organism gain access? She had no sore throat, she had a negative throat culture, and no primary focus anywhere else could be found. And yet somehow that particular organism got into her peritoneal cavity.

Recently, many months after the epidemic referred to, a patient eight months pregnant was admitted to a private ward in the Sloane Hospital under the care of Dr. Damon with whom I saw her. She had all the symptoms and signs of a peritonitis. We did an immediate laparotomy and found a generalized peritonitis but no primary focus. A hemolytic staphylococcus was recovered from the peritoneal fluid. How did she become infected?

The pregnant and puerperal woman seems to be more susceptible to organismal infection than the nonpregnant and her resistance to infection when it is once established to be diminished. During the prevalence of streptococcal infections in the community she may apparently fall a victim to sepsis, the organisms entering her body by insidious ways and not necessarily by direct gross inoculation of the genital tract by those in attendance upon her. Until we know a great deal more of the life history, the methods of growth, the variations in virulence, and the portals of entry to the body of the bacteria of infection we shall be unable to prevent all cases of puerperal fever.

#### PATHOLOGY OF POSTPARTUM INFECTIONS

When infection does occur during or after labor a great variety of lesions may result. For the purpose of this symposium these can be only briefly reviewed in order to bring them into comparison and contrast with inflammatory lesions originating in other ways.

Owing to the great vascularity of the postpartum uterus, the large sinuses opening on the surface of the mucosa, the numerous and widely dilated lymph channels, and the rhythmic contractions of the uterine muscle, there is a greater tendency to wide dissemination of organisms by blood and lymph stream than in any other type of infection. If the organism, say a streptococcus, is a virulent one, it seldom stays long localized. By which channels—blood or lymph—it spreads

seems to depend to a certain extent upon the particular organism and upon whether the infection follows a full-time labor or an abortion. In a series of one hundred and sixty-three postmortem examinations in cases of postpartum and postabortum sepsis, Halban and Koehler found evidence of lymphatic spread in one hundred and fifteen and in forty-eight of these it was the sole method of dissemination. There seems to be a greater likelihood of direct blood stream invasion after abortion than after full-time labor. In five fatal cases of hemolytic streptococcal infection, all following full-time labor, recently investigated at the Sloane Hospital, autopsy showed in all of them a direct lymphatic spread through the uterine wall to the lymphatics in the cellular tissue and thence to the serous surfaces—pleura and peritoneum. In none was there any septic thrombophlebitis of the pelvic veins. In the majority of the cases with positive blood cultures the blood stream invasion occurred late in the disease, viz., on the second, fourth, eighth, tenth, eleventh, eighteenth, and twenty-sixth day postpartum. This together with the other evidences of lymphatic spread indicates that the organisms probably reached the blood through the thoracic duct. It is in cases of this type that the operation of drainage of the thoracic duct might do good.

In other series of cases there has been a greater incidence of direct blood stream infection, with or without septic thrombophlebitis, but in general it is fair to state that this is more common postabortum than postpartum.

Direct invasion of the peritoneal cavity through the lumina of the tubes is more frequent after abortion than after full-time labor, hence early peritonitis is commoner in the former than in the latter. Drainage of the peritoneum either through the abdominal wall or vaginal fornix is, therefore, more likely to be followed by good results in cases of peritonitis following abortion than in those following full-term labor where the peritonitis is so often a part of a general lymphatic and blood infection and really a terminal phenomenon. Peritonitis with loculated collections of pus throughout the cavity, often with abscesses in the ovary, is sometimes found in long drawn out cases of puerperal streptococcal infection and is practically always the result of a lymphatic spread. We had one such case in the Sloane epidemic of a year ago in which several of these abscesses were opened and drained but the patient ultimately died on the seventy-fifth day of her disease. At no time had she had a positive blood culture.

*Localized Inflammation.*—Fortunately the vast majority of puerperal infections do not become widely disseminated but there is this potentiality in all of them. More frequent and careful blood cultures have shown that organisms are present in the blood stream much more often than we formerly supposed and many believe that in every

intrauterine infection there is some escape of organisms into the blood. For this reason I am in agreement with those who would discard altogether the term "sapremia" as applied to puerperal uterine infections for I regard every case as a potential septicemia. In teaching I have found this view a great help in bringing home to the student the inadvisability of any interference with the interior of the septic uterus until we are reasonably sure that the activity of the organisms has ceased, as evidenced by a normal temperature for some days. From our experience of both active and conservative treatment most of us have no hesitation in preferring the latter. When so treated the majority of cases show no wide dissemination. In some the infection seems to remain localized to the interior of the uterus producing for some days a profuse, fetid lochia, tenderness, and delayed involution of the uterus and fever. Such patients make an apparently perfect recovery although as we shall discuss later there may be after effects in the form of chronic metritis and fibrosis uteri with its attendant symptoms.

In some of these cases where there is more or less localized tenderness over one or both sides of the fundus the question arises as to whether this is indicative of a salpingitis or of a cellulitis in the broad ligament. The latter is much more common than the former after full-time labor. The localization of the inflammatory process in the cellular tissue by lymphatic extension in a case of serious puerperal infection is something to rejoice in. It is very seldom that wide lymph or blood spread occurs in such. Careful watch on the size and character of the exudate and frequent leucocyte counts will reveal any pus formation and dissection along the cellular tissue planes. Early incision with drainage is called for under these circumstances. It is extraordinary how large these cellulitic exudates may become and how quickly and completely they absorb without the formation of pus and apparently without leaving behind any lesion within the peritoneal cavity. Such patients are less likely to suffer from late after effects such as chronic pelvic pain and sterility than those in whom there has been a postabortal infection. The following cases illustrate these points:

Mrs. R. developed a severe streptococcal infection beginning on the second day postpartum. Temperature was maintained at a high level for nineteen days and from the sixth day of her illness a mass was palpable in the pelvis and lower abdomen, which was diagnosed as a cellulitic exudate. Her temperature did not become normal until the fifty-second day and on discharge from hospital some thickening could still be felt on both sides of the uterus and around the cervix. Blood cultures throughout her illness were sterile. On her first visit to the Follow-Up Clinic two weeks after discharge the pelvis was found to be absolutely clear. This patient, fourteen months later, is five months pregnant and feeling perfectly well.

Mrs. C. had a severe hemolytic streptococcal infection beginning on the second day postpartum. Temperature intermittent and often reaching 105° F. up to the twentieth day. Blood culture negative. Marked swelling and induration developed in the pelvis all round the uterus. On the forty-first the exudate was explored and some pus evacuated. Patient was discharged from hospital on the fifty-seventh day when there was still considerable thickening and induration present but her temperature had been normal for a week. Four months later the mass had completely disappeared and there was only a little indefinite thickening to be felt. One month later she became pregnant. Her pregnancy was uneventful and she was delivered normally of a healthy seven and one-half months child followed by a normal puerperium. Examination of the pelvis one month after this showed no pelvic pathology.

Mrs. L. had a severe hemolytic streptococcal infection beginning on the second day postpartum. She had a temperature ranging between 104° and 100° F. for nineteen days. Blood culture negative. On the fifth day of her illness a tender mass could be palpated, to the left of the uterus, filling up the vaginal fornix. This mass had disappeared by the twenty-second day. Examination of the pelvis fourteen months later showed the uterus freely movable. No thickening to be felt. Cervix healthy with complete absence of catarrh.

Mrs. P. developed a severe hemolytic streptococcal infection on the third day of her puerperium. She was extremely ill. Very definite induration in both broad ligaments was detected on the tenth day of her illness. The inflammatory mass in the pelvis increased in size until the twenty-fifth day when it gradually began to decrease. On her discharge from the hospital on the fifty-first day it was still quite definite, most marked to the right, and in front of, the uterus. Two months later the mass had completely disappeared but slight thickening could be felt at the side of the cervix. Two months afterwards she became pregnant and had a normal pregnancy, labor, and puerperium.

For the following three histories I am indebted to Dr. W. E. Caldwell:

Mrs. S. was seen in consultation by the late Dr. W. E. Studdiford after attempted forceps delivery had failed. Her temperature was 104°, and Dr. Studdiford performed a craniotomy. Temperature continued high and a hard mass was palpated on the right side of the abdomen by the fourth day. On the sixth day there was a similar mass on the left side. These masses ultimately converged and when joined they reached above the umbilicus. On the twelfth day a double femoral phlebitis developed. Temperature reached normal at the end of six weeks and the mass began to diminish and had entirely disappeared six weeks later. Subsequently the cervix was amputated and the pelvic floor repaired. A year after this the patient became pregnant and was delivered by cesarean section at which time there was no evidence of any inflammatory disease in the pelvis.

Mrs. B. seen in consultation by Dr. W. E. Caldwell who performed craniotomy after her doctor had failed with forceps. Temperature at the time of delivery was 103° F. On the seventh day postpartum an indurated mass could be felt in the abdomen reaching up to the umbilicus. A week later a quantity of pus was evacuated through the posterior fornix. At the end of six months there was still considerable thickening to be felt in the pelvis. At the end of a year the uterus was found to be freely movable and in good position. Six months later she became pregnant. Cesarean section was performed at term. The only pathology found in the pelvis was marked varicosities in the broad ligaments.

Mrs. F. became severely infected after a craniotomy following failure to deliver by forceps by an outside practitioner. The temperature from the time of operation till six weeks later ranged from 100° to 104° F. On the fifth day induration could

be felt on both sides of the uterus. This extended until the inflammatory mass reached to the level of the umbilicus on both sides. By the end of three months these masses had disappeared and in another three months she was again pregnant. Cesarean section was performed at term and not a trace of adhesions or of inflammatory reaction could be found. Eighteen months later she had a second cesarean section.

These cases serve to illustrate the complete way in which inflammatory exudates following full-term labor may clear up and emphasize the wisdom of noninterference with pelvic inflammatory masses due to puerperal infections. I think we are all agreed on that, but the fact requires frequent repetition, for many lives are still being sacrificed through attempts at their extirpation. Even in those cases where the thickening persists and the patients suffer from chronic pain and disability we should hold our hand as long as possible. In some such there is tubal inflammation and peritonitis in addition to the parametritis. Curtis has shown that the streptococcus may remain potentially active for long periods of time in such tubes, and may cause serious and fatal reinfection when the tissues are contused and lacerated, as they always are, in dividing the dense adhesions present in such cases.

As has been mentioned, direct tubal infection with or without the subsequent formation of a pyosalpinx is less frequent after full-time labor than after abortion but it does occasionally occur. Most of these cases are gonococcal in origin. The old idea that the gonococcus may lie latent in the tubes during pregnancy, springing into activity after the first week of the puerperium has been discredited by the investigations of Curtis who failed to find gonococci in any tube after ten days of normal temperature. We must, therefore, come to the conclusion that when a gonococcal pus tube does develop in the puerperium it must be by an ascent of the organisms from the lower genital passages in the early puerperium. Hence the necessity for active treatment during pregnancy. The treatment of such cases as do develop pyosalpinx should follow the general lines of conservatism practiced in the nonpuerperal woman.

The indications for active surgical treatment in puerperal infections are few in number. Occasionally a definite abscess develops in the uterine wall as the result of a lymphatic spread and, in such, hysterectomy is called for. The diagnosis of such cases can only be made after some time has elapsed and the uterus is found to be definitely enlarged, irregular in outline, and tender. Such findings are compatible with the presence of a degenerating fibroid and the differential diagnosis may be difficult or impossible till the abdomen is opened.

Much has been written regarding the surgical treatment of septic pelvic thrombophlebitis and some brilliant results have been recorded. In 1917 Jeff Miller computed the mortality in the cases recorded in

the literature as 32.9 per cent. Baldwin advocates the complete extirpation of the uterus along with the thrombosed veins without ligation and with free drainage per vaginam. From this procedure he had a mortality of 29.8 per cent. Operative treatment is certainly advisable in some cases but the difficulty is in making a correct diagnosis. This cannot be done until symptoms have been present for a considerable time. The persistence of the characteristic swinging temperature, with frequent rigors and the detection in the pelvis of a more or less definite thickening on one or both sides of the uterus, should make diagnosis probable. In determining for or against operation in such a case, it is necessary to take frequent blood cultures. If organisms cannot be cultivated, or are only present at the time of the rigors and not in the intervals, the case is favorable. In such there is no true septicemia. There is merely a flooding of the blood with organisms from time to time, and then they are killed off in the blood stream. If a positive culture can be obtained at all times a general septicemia is present, and the outcome of operation is not likely to be good. In the great majority of cases there is some cellulitic involvement in the neighborhood of the veins, and the more rational procedure would seem to be that carried out by Baldwin and others of cutting across and removing the veins, and, if necessary, the uterus, and draining the pelvis rather than mere ligation.

Operation must not be postponed too long, but, on the other hand, many cases of puerperal sepsis which recover must have septic thrombosis in the pelvic veins. It is seldom that a sufficiently definite diagnosis, to justify operation, can be made before a fortnight or three weeks after the initial infection, and, in many cases, it will be longer. I have had no personal experience of the operation. In one case with characteristic symptoms I had all preparations for operation made on two separate occasions, but each time put it off. After running a very hectic temperature, with rigors often twice daily for seven weeks, that patient ultimately recovered.

While it is thus true that in the majority of serious cases of puerperal infection which survive, recovery is complete and there are few after effects, it may be otherwise with some of the less severe cases.

We have still much to learn regarding the subacute and chronic infections of the cervix and uterus initiated at childbirth and in the puerperium. What are the organisms principally responsible for these cases of endocervicitis of which we see so many? Are they indigenous bacteria of the vagina or are they introduced from without? Can we by paying more attention to the cervix in the early and late puerperium prevent their growth and action?

I was much impressed by a paper which Dr. Goodall read at a recent meeting of the New York Obstetrical Society in which he stated that inflammatory lesions of the cervix, many of them due to a strepto-



coccus, were demonstrable at an early stage of the puerperium. How many of us on the discharge of our patients from hospital make a thorough specular examination of the cervix and when lesions are found at once institute treatment? I confess myself a sinner in this respect and there may be others. Here is a big field of preventive medicine right at our hand.

Is there not an inflammatory etiology behind many of the cases of chronic metritis and fibrosis uteri with their attendant menorrhagias? Histologic examination does not always give definite evidence of it but the feeling of well-being and the improvement of health in these patients after hysterectomy has always seemed to me to be out of proportion to what might be expected from the mere stopping of the excessive bleeding. It is as if some definite focus of septic absorption had been removed. A similar rapid improvement in general health does not in my experience follow radium or x-ray treatment.

In this necessarily incomplete consideration of the subject of post-partum pelvic infections I have been able to touch on only a few points, leaving to those who will follow in the discussion the filling in of the gaps.

To focus that discussion the following broad generalizations may be stated:

1. The majority of severe puerperal inflammatory lesions are due to infection by organisms introduced from without.
2. The portal of entry of these organisms may not always be the external genital canal.
3. Indigenous vaginal and cervical organisms may cause serious pelvic inflammation and also less severe and more chronic lesions of cervix and uterus.
4. Localized puerperal inflammatory exudates tend to absorb and usually do so completely, leaving no after effects.
5. In serious infections conservative rather than radical treatment gives the best results.
6. In the less severe infections of the cervix and uterus more accurate diagnosis and earlier treatment might prevent later trouble.

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## THE TREATMENT OF SEPTIC ABORTION

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THE problem of abortion has become world-wide. A steady increase in its frequency had been noticed in all countries for the past thirty years or more, but in the last decade this increase has been positively appalling. In 1890, there was, in Germany, one abortion to every ten births;<sup>1</sup> in 1911, the proportion had dropped to 1:5.<sup>2</sup> In 1919, in Hamburg, to quote but one example, one abortion occurred for every two births;<sup>3</sup> and in 1926, there were in the same city two abortions for every three births.<sup>4</sup> The actual number of abortions each year in Germany is somewhere between 500,000<sup>2</sup> and 875,750.<sup>5</sup>

Conditions in this country are, probably, not quite so bad though for lack of any statistics we may not be too sure about it.

This enormous increase is brought about almost altogether by criminal interruption of pregnancy whether carried out by shady physicians or midwives, by persons without any sort of previous training, or by the patients themselves. Compared with this, all other etiologic factors of abortion sink into insignificance. Ninety per cent<sup>2</sup> or more<sup>5</sup> of all abortions are criminal abortions.

A large number of such abortions becomes febrile, that is, results in infection. In 1917, the percentage of septic abortions was estimated at about 10;<sup>6</sup> today it is, probably, much higher. Death from infection occurs in so great a proportion that the mortality of criminal abortion far exceeds that of childbirth in general;<sup>5</sup> while the morbidity with its far-reaching influence upon the later life and health of the individual remains wholly incalculable.

There is, therefore, every reason to search for the most efficient treatment of criminal abortion, since we as physicians cannot hope to prevent the widespread evil by influencing its underlying social, economic and moral causes.

Treatment of criminal abortion is synonymous with that of septic abortion; for, owing to its clandestine nature, we hardly ever are called upon to treat a case of this kind until complications have set in. Such a patient, as a rule, has been bleeding more or less profusely for some time and, consequently, is in a state of secondary anemia. There is usually an ill-smelling vaginal discharge. Fever, varying in degree, is present and is particularly ominous if the pulse rate is too high in proportion. Chills and pain denote complications outside of the uterus, such as parametritis, pyosalpinx, pelvic peritonitis, throm-

bophlebitis, and general peritonitis; and there is always the possibility that the abortionist may have produced a perforating traumatism in some part of the genital tract.

I am fully aware that a febrile incomplete abortion may occur spontaneously either by ascent of bacteria from the vagina or cervix or by way of the blood stream in acute infectious diseases, but I think it is a good practical rule to consider every such case a criminal abortion until the contrary has been proved.

This attitude must needs influence our therapeutic actions and assist us in selecting from the multitude of remedial measures which have been recommended. This very multitude is, of course, a disheartening indication of the fact that our treatment of septic abortion is far from satisfactory.

We may divide the therapy into general or systemic, and local treatment.

As to general treatment, three methods have been suggested.

Specific therapy by means of vaccines and serums, despite its generally disappointing results, still has its advocates.<sup>7</sup>

Chemotherapy, that is, the introduction of antiseptic solutions into the circulation, has always been unsuccessful and often enough disastrous in its effects. Nevertheless it is being revived at present in the intravenous injection of mercurochrome though the necropsy findings studied in the chief medical examiner's department of the city of New York<sup>8</sup> leave no doubt as to the high toxicity of mercurochrome whereby lesions in kidneys and intestines are produced which may contribute to death.

Moreover, it seems an elusive hope in any blood-stream infection to kill all bacteria circulating in the blood by injecting a bactericidal solution into the vein. If there are no bacteria, but only their toxins in the blood, it is even more difficult to see how any such treatment can be of benefit. At any rate, any antiseptic solution strong enough to kill bacteria, will also do damage to the blood cells, the walls of the blood vessels, and the surrounding tissues.

Much better founded theoretically and far superior in its practical results than either of the two methods, is the nonspecific protein therapy by which the natural power of resistance against infection is raised and the means of self-defense of the body are stimulated to most intense activity. Therein lies at once its strength and its limitation. For it is obvious that hopelessly damaged or worn-out cells cannot be revived by any stimulus however powerful. The percentage of failures, therefore, will be proportionate to the stage and intensity of the infection when it is first encountered. The relative harmlessness of protein injections, however, justifies a trial even in severe infections. Whether the protein therapy takes the form of intramuscular injections of milk, as advocated by me before this society four

years ago<sup>9</sup> or of repeated blood transfusions, as recommended by Polak,<sup>10</sup> is, to my mind, of less importance than the promptness with which this treatment is instituted, and its employment in conjunction with other measures known to act as cell stimuli, such as fresh air, sunshine, strengthening food, etc.

Hofbauer<sup>11</sup> adds pituitary extract, administered intravenously, to protein injections, and Küstner<sup>12</sup> recommends strong alcoholic drinks in large doses, both with the view of stimulating the heart.

The local treatment of septic abortion revolves about the question: Should the aborting uterus be emptied in the presence of fever? Here again we find three main procedures, namely:

1. *Active Treatment*.—In every febrile abortion the uterus is cleaned out immediately unless there are inflammatory complications in the vicinity of the uterus. Whether the evacuation should be done by digital or instrumental curettage is still a moot point.

2. *Expectant Treatment*.—Place the patient under a generally strengthening régime and wait for the fever to subside. From three to eight or more days later evacuate the uterus if the latter has not emptied itself spontaneously by that time.

3. *Conservative Treatment*.—No local manipulations are permitted, and the expulsion of the uterine contents is brought about solely by quinine, pituitrin, and the like.

The advocates of both the expectant and conservative treatments consider immediate evacuation indicated only if a dangerous hemorrhage occurs. This, however, is very rare.

We cannot pass lightly over any of these conflicting views because each of them is represented by men of recognized ability, experience, and judgment. The most natural thing would be to adopt that method which statistically has yielded the best results. Unfortunately, the problem cannot be solved in this way. Heynemann<sup>2</sup> has shown very convincingly the many sources of error which in this particular question render statistics unreliable. Moreover, if one studies the figures presented in the literature, the actual differences in the end-results from one or the other form of treatment are much too slight to permit of definite conclusions.

The advocates of active treatment claim that in daily practice the hand of the physician is forced by the demand on the part of the patient or her family for immediate relief. Any temporizing will drive the patient to another physician. An abortion, they say, terminates only when the uterus is empty. Bleeding ceases then at once, and fever, perhaps with the exception of a solitary chill after curettage, disappears promptly. Convalescence is, therefore, shortened; the reduced duration of hospitalization and earlier return to work lessen the economic hardship.

Such a favorable outcome, however, is not always the rule. Curettage is often followed by a serious aggravation of the infection. The protective wall of leucocytes and fibrin is broken through, and the organism may be flooded by bacteria or their toxins. Hence, a superficial and not dangerous infection might conceivably be converted into one with strongly invasive qualities.<sup>14</sup> Parametric or perimetritic inflammation may then be the consequence, and in that case convalescence would be considerably prolonged. If, on the other hand, the infected uterus is left at rest, the virulence of the bacteria usually decreases;<sup>15</sup> and the fever, as a rule, disappears spontaneously, at times even quite rapidly. Involvement of the pelvic structures seems to be less frequent under this régime.

At any rate, it must be admitted that watchful waiting can do no harm. A death which occurs under conservative management, can probably not be prevented by active intervention. The latter carries with it also the danger of perforation with curette, dilators, placental or dressing forceps, and even the finger. The bleeding which to most physicians is an indication for immediate interference, is hardly ever copious enough to be alarming and can, moreover, be held in check by a skillful tamponade of the vagina which, in turn, encourages spontaneous expulsion of the infected tissues.

Which of these opposing plans of treatment are we going to teach our students, which shall we recommend to physicians? For, remember, this problem concerns the general practitioner quite as much as the obstetric specialist, because the great majority of septic abortions, in this country at least, is cared for outside of hospitals. One can readily imagine how confused a reader in search of information would be if he found in one textbook a definitely active therapy espoused and in another textbook an almost nihilistic conservatism advocated with equal positiveness. It seems to me that the American Gynecological Society because of its preeminence in the country, can render the medical profession a distinct service by endorsing a policy which would serve specialist and practitioner alike.

In proposing such a course of action, it might be well to bear in mind that every septic abortion is almost certainly a criminal abortion, that we are taking charge of a case without knowing the kind of infection and extent of traumatism inflicted, and that, if death ensues, we are likely to be blamed for the sins of the abortionist. This consideration should teach us caution and warn us against an overactive management. A wholly conservative attitude, on the other hand, is apt to meet with practical obstacles and opposition on the part of the patient.

The best mode of procedure is probably a compromise between the two extremes on principles of unification of treatment which may be

acceptable to everyone. With this end in view, I venture to submit the following theses to your discussion:

1. Every febrile abortion is potentially a serious condition which should be treated in a hospital.

At the present stage of our knowledge we are unable to foretell the virulence of the infection. Laboratory findings are only too often misleading. On the other hand, even a slight and apparently innocent elevation of temperature may be the forerunner of a grave sepsis; this was well illustrated in a case mentioned by Baer and Reis.<sup>13</sup>

2. Energetic systemic treatment is instituted at once. This consists of rest in bed, fresh air, forced feeding, alcohol, protein therapy (milk injections, blood transfusions), hypodermoclysis, etc.

3. The initial examination is made cautiously.

a. If there are definite complications outside of the uterus and even if there is only tenderness on palpation, strict conservatism must be observed. We then treat no longer the abortion, but its complications, and at most we may resort to quinine and pituitrin.

b. If ovular remnants protrude from the dilated cervix, they are pulled out with the placental forceps.

4. If a severe hemorrhage occurs at any time during the first two days, the vagina is gently packed with iodoform gauze, the end of the strip extending into the cervical canal.

5. If reexamination on the third day reveals no complication or tenderness outside of the uterus, curettage is performed irrespective of fever.

Proper operative technic is of decisive importance. The cervix is gently dilated in general anesthesia. The dilatation should be made with Hegar dilators, not with instruments of the Goodell type because with the latter, tears of the cervix are not always avoidable. The uterus is curetted quite lightly with a very large, sharp loop curette. The size of the instrument avoids the danger of perforation, particularly if, prior to the dilatation, 1 c.c. of pituitrin has been injected intramuscularly. The sharp curette, used in this manner, is far less violent than the blunt curette which requires much more force in dislodging placental remnants from the uterine wall.<sup>16</sup> The same objection applies to finger curettage, as it entails too much dilatation and a great deal of kneading and massaging of the uterus.

6. After evacuation, the uterus is kept contracted with ergot, and milk injections are continued until the fever has permanently disappeared.

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METROPOLITAN BLDG.

## TUBERCULOUS SALPINGITIS

BY CHARLES C. NORRIS, M.D., F.A.C.S., PHILADELPHIA, PA.

FIVE to ten per cent of all cases of salpingitis are of tuberculous origin. In the laboratory of Obstetrics and Gynecology at the University of Pennsylvania tuberculosis has been demonstrated in 7.7 per cent of all cases. In cases of tuberculosis of the female genital tract the tubes are affected in 90 per cent, the corporeal endometrium in 50 per cent, the ovary 40 per cent (oöphoritis 5 per cent, peri-oöphoritis 35 per cent), cervix 2 per cent, vagina 2 per cent, external genitals 1 to 2 per cent.

All cases should be viewed as secondary, although there are a few probably authentic primary cases recorded in the literature. Primary genital tuberculosis is so rare that many authorities deny its existence. Experimentation has shown that large numbers of virulent tubercle bacilli may be deposited in the vagina without the animal developing tuberculosis. When tuberculosis does develop, it is usually distant from the site of inoculation. The route of infection in these cases is generally through the pelvic lymphatics. The proportion of "takes" may be increased by a preliminary excoriation of the lining membrane of the vagina or by the production of a preliminary chemical or bacteriologic vaginitis. Even if this is done, the genital tract is relatively infrequently attacked although distal lesions may result. The wives of men suffering from tuberculous epididymitis rarely develop genital lesions despite the fact that virulent tubercle bacilli must frequently be deposited in the vagina with the seminal discharges. The fact that a few ascending infections do apparently occur as a result of laboratory experimentation and that a few rare instances of ascending genital tuberculosis have been observed in women should lead to precautionary measures being adopted by men known to be suffering from genital lesions. The fact of the matter is that even in these later cases other routes of infection are more likely than is the ascending one.

The tubes are generally the primary genital foci and the ampullas of the tubes the first portion attacked. The corporeal endometrium

is invaded in about half the cases and is probably often the result of extension from the tubes. Tuberculous endometritis is often somewhat irregular in its distribution, especially in the early cases, and the area surrounding the internal ostia is most frequently attacked. In some cases the endometrium is probably invaded at the same time as the tubes and in these is the result of a blood-borne infection. From the tubes the infection may spread to the peritoneum and result in a general peritonitis or less frequently the reverse may be the case. The well-established fact that the tubes are usually the primary intraperitoneal foci is of importance when considering the treatment of salpingitis. Preexisting inflammation is probably a predisposing factor to the development of tuberculous salpingitis.

Many cases of tuberculous salpingitis are of the unsuspected variety, Williams found 75 per cent were of this type. A study of our cases at the University of Pennsylvania showed that it was possible to make the diagnosis from the macroscopic appearance of the specimen or preoperatively in 25 per cent of cases, 50 per cent were suspected, and 25 per cent were entirely unsuspected prior to the histologic examination. In tuberculous infections of the tube the external abdominal ostia exhibit a tendency to remain open longer than in any other form of infection. This is especially the case when ascites is present. Tubercles may be visible upon the peritoneal coat of the tube and are practically always so when the condition is secondary to a general peritonitis. Cheesy or caseous material is present in the lumen of the tubes in advance cases and particles of this material may sometimes be attached to the fimbria. Tuberculosis sometimes results in the formation of nodular or small tumor-like enlargements, especially in the isthmus of the tube, the so-called salpingitis ischmica nodosa, although similar lesions may be observed in nontuberculous conditions. Histologically tuberculosis sometimes produces a picture which is superficially suggestive of carcinoma. The epithelium may be reduplicated, the cells irregular in size and staining properties and a false appearance of new gland formation may be present. The presence of tubercles is characteristic and the differentiation from carcinoma is easily made by an experienced pathologist.

A family history of tuberculosis may be present and a history suggestive of tuberculosis elsewhere in the body is generally obtainable. The lungs are the primary site in the majority of cases. A history of frequent "colds," chronic coughs, and pleurisy or of bone or joint lesions may be present. A period during which there has been a slight but unaccounted for evening rise in temperature is suggestive. In a certain proportion of cases there have been a previous general peritonitis usually of the ascitic variety. In some individuals the general health has been poor and they have been underweight for years. Careful questioning will often elicit the fact that there has been a



mild exacerbation of the primary lesion a few weeks or months prior to the development of the pelvic symptoms. Despite the fact that nearly all cases are secondary, occasionally no definite history suggestive of the primary lesions is obtainable. The onset is often insidious, and the course marked by moderate exacerbations and remissions. The resistance of tuberculous salpingitis to the ordinary expectant treatment usually employed for pelvic inflammatory disease is marked and may be the first point to suggest the etiology of the condition. Tuberculous salpingitis is nearly always bilateral, hence pain is present in both ovarian regions. Nausea, vomiting, tympanites, constipation, anemia, moderate leucocytosis and a shortened sedimentation time and the usual symptoms of a pelvic inflammatory disease are present in varying degrees. Irregular fever varying from  $99^{\circ}$  to  $103^{\circ}$  F. with its accompanying phenomena is the rule. All the symptoms are variable. In some cases the symptoms produced by the primary lesion overshadow those of the salpingitis. Amenorrhea or scanty, irregular or painful menstruation frequently precedes the onset of the pelvic symptoms. Persistent diarrhea is suggestive of an intestinal involvement.

Apart from the previous history of the case and the tendency of the disease to run a more or less chronic course despite treatment, tuberculous salpingitis should be suspected when there is an absence of the symptoms of gonorrhea or a previous pregnancy or when the lower genital tract is normal and presents no signs of an ascending infection. Salpingitis in the virgin is nearly always of tuberculous origin. Its bilateral character, tendency to resist the ordinary expectant treatment, poor general condition of the patient out of proportion to what would be expected from the pelvic lesion are all points suggestive of this variety of infection. The development of a subacute or chronic general peritonitis usually of the ascitic variety and evidence of a primary lesion elsewhere in the body are all more or less characteristic of tuberculosis. A small amount of free fluid is often demonstrable in the culdesac even in the early stages of the disease. In the gonococcal type of pelvic inflammatory disease the endometritis and cervicitis precede the salpingitis, whereas with tuberculosis the reverse is often the case; hence, in the latter variety leucorrhea may be absent or develop subsequently to the onset of the tubal lesions.

*Treatment.*—The primary focus must be accorded due consideration and even in those cases where no primary focus can be demonstrated due precautions should be instituted and the case treated as if a small quiescent lesion were known to exist. In this connection, it should be remembered that physical signs of a pulmonary lesion generally underestimate the extent of the disease. Practically all these cases are secondary and the hazards of operation, therefore,

greater than in the nontuberculous individual. As a result, indications for operation should be more pronounced than in the commoner varieties of salpingitis. Fortunately, in the group in which the tuberculous character of the infection is not suspected the primary focus is generally small and quiescent and these patients usually bear even ether anesthesia well. As the primary focus is usually in the lungs, anesthesia is an important factor. Here, if anywhere, spinal anesthesia possesses many advantages. Local anesthesia may be possible for some of the milder cases but the fact that many cases of tuberculous salpingitis present operative difficulties in the shape of dense adhesions and often massive adnexal lesions with matting together of the omentum and intestines make this form of anesthesia unsatisfactory for the average surgeon.

The tendency for the disease to resist all forms of expectant treatment, the frequency of the subsequent development of a general peritonitis and the fact that the tubes are usually the primary intra-peritoneal focus call for their removal when this is not contraindicated by other existing conditions. When operation is necessary, conservative surgery should be performed. A panhysterectomy is rarely indicated. Bilateral salpingectomy should be the rule, and generally it is better to remove both tubes even if only one is macroscopically diseased. Sterilization of the patient is less disadvantageous in these than in other forms of salpingitis. The corporeal endometrium is attacked in about half the cases, hence a high supravaginal amputation with cauterization of the cervical canal from above is often necessary. Drainage adds to the likelihood of fistulas and should be avoided when possible. As in all forms of pelvic inflammatory disease operation is rarely indicated during the acute stage of the disease. A preliminary course of expectant treatment is nearly always advisable and in a proportion of cases is curative. In addition to the expectant treatment employed for the commoner varieties of pelvic inflammatory disease, certain special measures are advisable in those cases suspected of being of tuberculous origin. Rest, fresh air, sunshine, preferably at an altitude of from 3000 to 5000 feet, forced caloric diet, and whisky in the form of milk punches is indicated. Heliotherapy is especially valuable, but should not be pushed when acute pulmonary lesions are present. Dretzka<sup>1</sup> and Gauvain<sup>2</sup> emphasize the value of sunlight. Heliotherapy should be regarded as an adjunct but not as a specific treatment. There is no satisfactory substitute for sunlight but artificial light may be tried when heliotherapy is impossible. Carbon arc light is said to resemble sunlight most nearly and daily treatment with a diffuse carbon light may be given, beginning with half-hour exposures and gradually increasing the duration of the treatment. Some authorities follow with ultraviolet rays.

X-ray therapy has been employed for the treatment of pelvic and peritoneal tuberculosis with good results. Siedamgrotzky<sup>3</sup> denies that the x-ray possesses any bactericidal action upon the tubercle bacilli. He attributes the beneficial effects obtained to the destruction of the tubercles and tuberculous granulation tissue and its replacement by a cicatrix. Martius<sup>4</sup> has reported the end-results secured in a series of 28 cases. These he divided into two groups. Group I was composed of 9 cases which were considered inoperable and were treated by x-ray therapy. In Group II there were 19 cases, all of which were submitted to operation. Of the inoperable cases 4 were cured, 4 improved and 1 died six months later of pulmonary tuberculosis. Group II consisted of two classes, the first Group II-A consisted of 8 cases of which 6 were correctly diagnosed before operation and 2 in which the tuberculous character of the infection was suspected. Of these 8 cases, 1 died shortly after operation, 3 succumbed subsequently, 1 from pulmonary tuberculosis, 1 from general miliary tuberculosis and 1 from a tuberculous meningitis. Group II-B consisted of cases in which the tuberculosis was unsuspected prior to operation. Of these, one died two years after operation from intestinal tuberculosis; the remainder were either improved or cured. Cassidy<sup>5</sup> reports 17 cases of pelvic or peritoneal tuberculosis treated with deep x-ray, 10 were cured, 2 improved, in 3 there was no change and 2 died. Uter<sup>6</sup> has employed x-ray therapy and reports a series of 24 cases treated with satisfactory results.

Many cases are clearly inoperable and these should be treated by hygiene, diet, fresh air, heliotherapy and x-ray as already indicated. For the mild or suspected cases similar treatment is indicated, but if improvement is not noted, removal of the intraperitoneal foci should be performed without undue loss of time. All postoperative cases should receive a routine course of hygiene, diet and heliotherapy. X-ray therapy is worthy of a trial. The dosage of x-ray varies considerably in different cases but is usually not sufficient to produce amenorrhea, and a castration dose is not required.

#### RESULTS

Total number of cases followed for 2-19 years	40
Total number of cases treated by operation	33
Total number of cases of salpingitis alone	22
Total number of cases of salpingitis and general tuberculous peritonitis	11
Mortality, immediate and late, all cases	22 per cent
Mortality, expectant treatment alone, all cases	32 " "
Mortality, expectant treatment and operation	9 " "
<i>Mortality Operative</i>	
Salpingitis	4 per cent
Salpingitis and general tuberculous peritonitis	18 " "
<i>Mortality, Late, All Causes</i>	
Expectant treatment	18 per cent
Expectant treatment and operation	9 " "

<i>Operative Morbidity</i>	
Average stay in hospital	26 days
<i>Results as Regards Cures</i>	
Cured or improved, expectant treatment	50 per cent
Cured or improved, operative treatment	72 " "

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TWENTY-SECOND AND CHESTNUT STREETS.

## FACTORS PREDISPOSING TO PYELITIS IN PREGNANCY

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THE effort placed before you in this paper is a preliminary report of a survey of the healthy pregnant and puerperal woman, in so far as the protective mechanism of her urinary tract is concerned.

We would emphasize the fact that, in this endeavor, we are in no way dealing with the active infection, "pyelitis."

In this study, covering a period of two years, we have attempted to carry our investigation through four main avenues:

1. Is there an interference with the proper ureteral and renal drainage?
2. Is there a constant ureteral and renal dilatation? If so, at what term does this begin; when does it reach the maximum; to what degree does this develop?
3. Is there definite stasis; at what term and in what degree does it occur?
4. What knowledge could be obtained of a potential infection?

The material used in this study consisted of seventy-eight women, forty-two in the antepartum and thirty-six in the puerperal state.

Of the antepartum subjects, fifteen were primiparae and twenty-seven multiparae. These patients were carefully chosen because the history, in each, was free of any evidence of renal infection.

The technic of the preparation of the patient was the same in all antepartum patients: Hospitalization for twenty-four hours previous

to examination, absolute rest in bed, forced water intake, the rectum emptied, vulva shaved, gynecologic scrub-up.

The investigation of the postpartum cases was necessarily delayed until such time as marked danger of infection to the genital tract had passed. Consequently our study in this series dates from the ninth to the twenty-fifth postpartum day.

The method of approach to our hypothetical questions was a detailed study from the urethral orifice to the pelvis of the kidney of each patient. The urethra was catheterized and a specimen of the bladder urine obtained for a complete analysis and cultural growth. The bladder was filled to capacity with a 6 per cent sodium iodide solution,

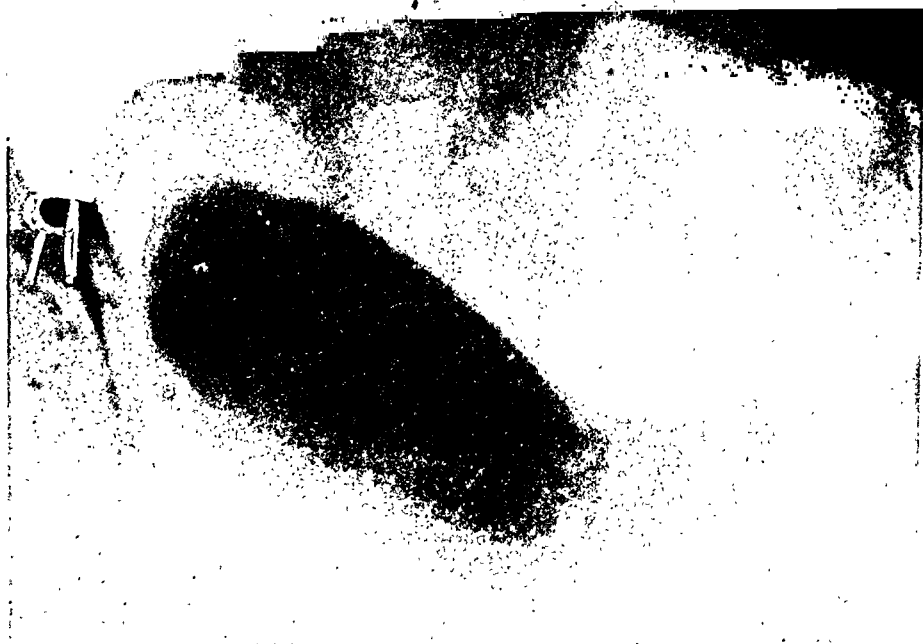


Fig. 1.—Cystogram in antepartum patient at seventh month. Shows a distortion of the bladder, characteristic of all antepartum women.

the patient placed in the exaggerated Trendelenberg position for ten minutes and a cystogram taken in this posture.

The Brown-Buerger cystoscope was introduced. The vesical neck, the ureteral orifices, and the bladder were closely studied for abnormalities. The ureters were then catheterized to the renal pelves with No. 5 French ureteral catheters. Specimens from the separate kidneys were taken for analyses and cultures. Following this, the renal pelves and ureters were filled with a 12 per cent sodium iodide solution and skiagraphed.

The iodide solution was injected slowly by syringe, both sides being filled simultaneously. No manometer was used. Great care was taken to inject slowly and to stop at the slightest evidence of pain. In this

way, we were able to obtain bilateral ureteropyelograms with but four instances of complaint upon the part of the patient.

*The Urethra.*—The urethra of the pregnant woman seemed to share with the rest of the pelvic organs in the marked general congestion. There existed a noticeable ease with which the cystoscope could be passed. In the postpartum woman the congestion had disappeared.

*Bladder.*—Other than the very pronounced changes occurring in the trigone, the bladder mucosa of the pregnant woman showed very few

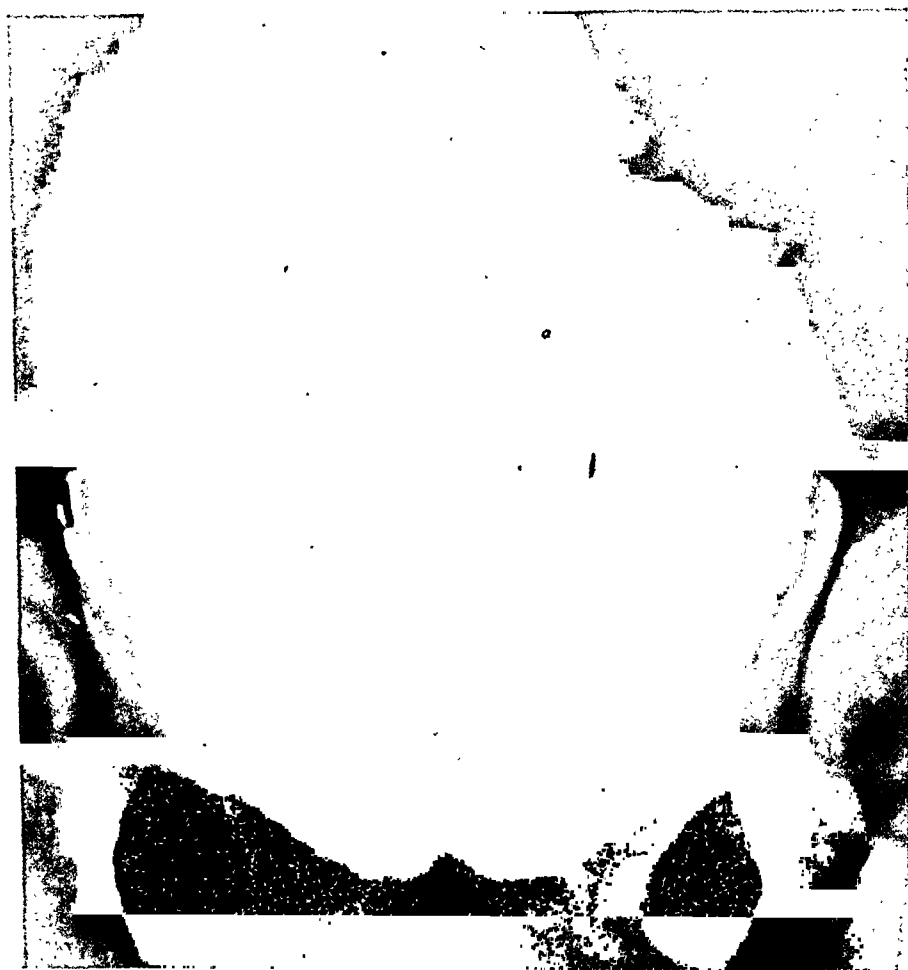


Fig. 2.—Cystogram in postpartum case at eleventh day. In contradistinction to the antepartum bladder this picture shows a marked relaxation.

differences from that of her nonpregnant sister. The vessels were larger, fuller, and at times tortuous. Cystography revealed some very interesting and sometimes startling changes in the contour of the bladder (Fig. 1).

The postpartum bladder had already resumed the appearance of that of the nonpregnant woman as early as the ninth day. Cystography showed no distortion but considerable relaxation (Fig. 2).

Contrary to the findings of Gauss,<sup>1</sup> corroborated by Stoeckel,<sup>2</sup> Hofbauer,<sup>3</sup> and Luchs,<sup>4</sup> we were unable to demonstrate an insufficiency

of the ureterovesical valve at any stage of pregnancy or in any of the puerperal cases in our series.

*Trigonum Vesicae.*—This portion of the bladder in the pregnant woman presents a decided change from the normal. *Congestion* of the mucosa became apparent early—in multiparae at the eighth week, in primiparae the tenth week—as in all the pelvic organs it was progressive as pregnancy proceeded.

At about this same period of pregnancy a new feature began to make itself apparent. There was a lengthening of the vesical trigone from the urethrovesical orifice to the interureteric ridge and a broadening of the base at the triangle, so that in many cases the ureteral orifices were really further apart than in the bladder of the nonpregnant woman. The impression obtained at cystoscopy was that a crowding upward of the trigone occurred, giving less room than usual. This was so pronounced in a number of cases that the cystoscope passed through the urethra directly on to the trigone, so that the catheterization of the ureters had to be performed from a considerable distance.

*The elevation* of the trigone was most noticeable along the interureteric ridge, which stood out with unusual prominence. The floor of the bladder fell away from the ridge rapidly and acutely, so that it became a valley, or even a *bas fond*. Perhaps this fact is responsible for the statement of Curtis<sup>5</sup> that a residuum exists in the bladder of the pregnant woman. Although we encountered no such finding in our series, it is not difficult to understand that in a certain percentage of cases a residual urine may occur, especially in the last trimester of pregnancy when the congestion, elevation and elongation of the vesical trigone are most pronounced.

*The Ureteral Orifices* presented no change from the normal, except as noted above; they frequently were more widely separated than usual, due to the broadening of the trigone. Ureteral catheterization presented no difficulty whatever from the ureteral orifice to the renal pelvis.

While the hypertrophy and hyperplasia of the muscle fiber and fibrous connective tissue, as put forward by *Hofbauer* in his recent monograph, may or may not completely involute as early as the ninth postpartum day, cystoscopic visualization of the bladder and trigone, at this date, showed a complete disappearance of the congestion, elongation, and elevation noted in the antepartum cases.

*Bladder Urine.*—The catheterized bladder urine in both antepartum and postpartum series showed no gross abnormalities. In our complete investigation of seventy-eight cases, albumin was present in but four; casts were found in only two.

TABLE I. BLADDER URINE

MICROSCOPIC AND CULTURAL GROWTH	ANTEPARTUM (PER CENT)	POSTPARTUM (PER CENT)
White blood cells	40.0	61.0
Frank pus	2.4	19.0
Coliform organisms	12.0	13.0
Coccal organisms	45.0	66.0
No growth	20.0	19.0

Microscopic examination and cultural growth of the catheterized bladder urine of pregnant and puerperal women presented, to our minds, definite findings, which were entitled to thorough study.

We were impressed with the large percentage of the occurrence of white blood cells. In our series we will consider the presence of white blood cells in the urine, when not due to blood, as clinical evidence suggestive of infection. Table I demonstrates a 42 per cent incidence of infections in the antepartum cases, which rose in the postpartum ones to 80 per cent.

The most surprising finding in the cultural growths was the evidence of some variety of the coliform bacillus in these apparently healthy pregnant and puerperal women. The presence of these bacilli must be taken seriously. The very fact that they were found indicates that they are making their way into the bladder from some source.

Regarding the coccal infections, which are usually considered as contaminations of technic, their high incidence in our series makes us regard them with suspicion and worthy of more extended investigation.

TABLE II. URETERAL URINES

	ANTEPARTUM		POSTPARTUM	
	RIGHT URETER (PER CENT)	LEFT URETER (PER CENT)	RIGHT URETER (PER CENT)	LEFT URETER (PER CENT)
White blood cells	23.8	9.0	8.0	11.0
Frank pus	0.0	2.4	2.7	2.7
Coliform organisms	9.0	9.0	2.7	11.0
Coccal organisms	50.0	35.0	61.0	29.7
No growth	56.0	47.0	36.0	63.0

Microscopic examination of the urines from both kidneys shows in the presence of white blood cells and frank pus, a marked decrease when compared with the same picture of the bladder urine.

Whereas a study of the coliform organisms demonstrated the persistence of these bacteria in the kidney urine in but a slightly lowered percentage. This would lead us to infer that a combined cultural study of the bladder and ureteral urines indicates a potential renal complication.

Of interest in this series was the occurrence of pyelitis in four cases, making its appearance in the earliest case three weeks after cystos-



copy. Three cases developed prenatally, one in a primigravida, two in the multigravidae. One demonstrating the attack, on the tenth postpartum day, was in a multipara. Everyone of these cases gave a positive coliform growth in the ureteral and bladder urines at the time of cystoscopy.



Fig. 3.—Ureteropyelogram, bilateral, in antepartum multipara at the sixth week. This shows early beginning dilatation of the ureters and renal pelvis. Note the absence of abbreviation in the lower ureters.

#### URETERAL DILATATIONS

Ureteral dilatations occurring during pregnancy have been fully recognized and freely discussed in the literature. Cruveilhier<sup>6</sup> was the first to observe ureteral dilatation in women dying during the

latter months of pregnancy and in the puerperium. Olshausen,<sup>7</sup> Prutz,<sup>8</sup> Lohlein,<sup>9</sup> Carson,<sup>10</sup> and others have made similar contributions to the literature. All these workers studied the autopsied woman. Kretschmer and Heaney,<sup>11</sup> Crabtree,<sup>12</sup> Pugh,<sup>13</sup> Corbus and Danforth,<sup>14</sup> and Hunner<sup>15</sup> are among those who have used the living subject for their observations.

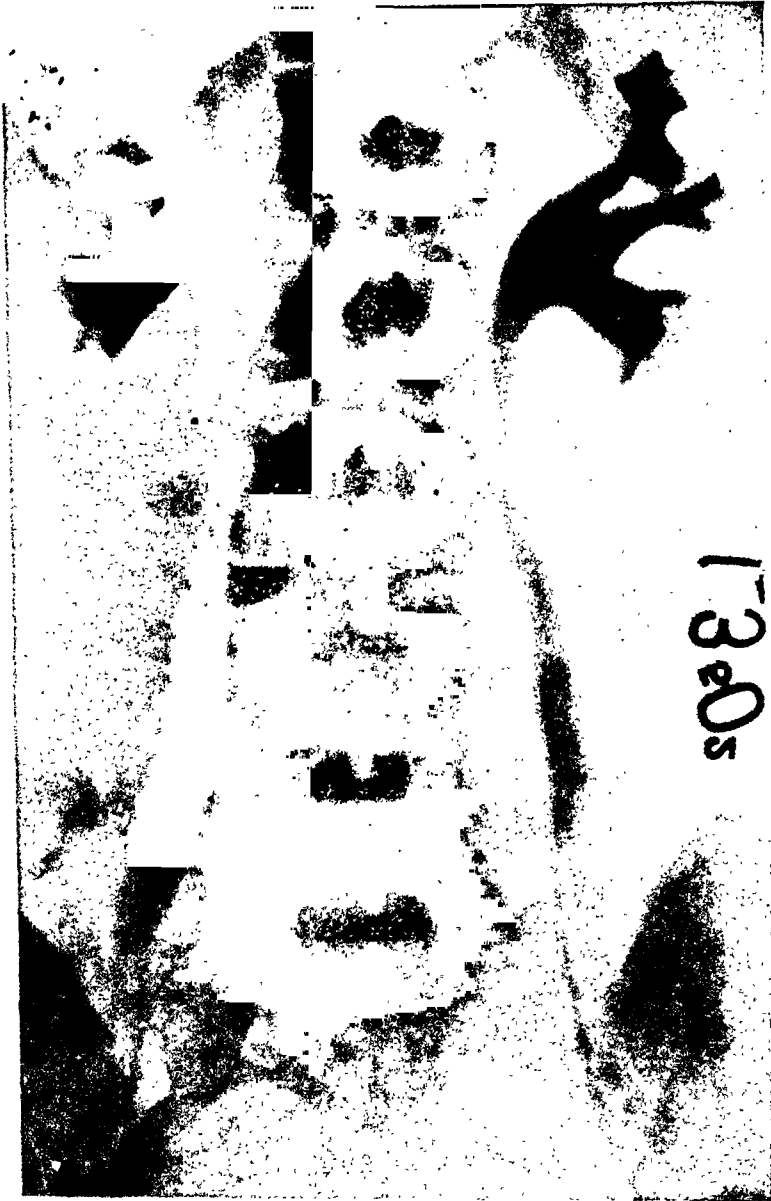


Fig. 4.—Ureteropyelogram, bilateral, in antepartum primipara at the tenth week. This shows a well-defined dilatation in both ureters with beginning hydronephrosis. Note the distinct abbreviation in the lower ureterograms.

Our effort will be to determine the earliest moment of onset in the primipara and multipara, with a comparison between the two. Secondly, to estimate the character of its progress with regard to the period of pregnancy. Finally, to determine whether or not this condition is persistent in the postpartum period.

TABLE III. URETERAL DILATATION

	ANTEPARTUM		POSTPARTUM
	PRIMIPARA (PER CENT)	MULTIPARA (PER CENT)	(PER CENT)
Right	100.0	100.0	86.0
Left	66.6	77.0	63.8
Bilateral	66.6	77.0	66.6
No dilatation right			13.8
No dilatation left	33.3	23.0	36.1

Dilatation of the ureter was noted by us as early as the sixth week in multiparae and at the tenth week in primiparae.

With regard to the character and progress of the dilatation, and considered at the different periods of pregnancy, our experience seems to show that dilatation, while appearing very early in both primiparae and multiparae, does reach its maximum shortly; at the twenty-fourth week in primiparae and the twenty-second week in multiparae. The amount of sodium iodide solution which could be injected into the ureter without pain did not vary to any extent, whether in early or late pregnancy. It may be stated that upon no occasion was an effort made to instill more than thirty cubic centimeters of the iodide solution. The average amount used by us in our experiments was fifteen cubic centimeters. Ureterograms made with thirty cubic centimeters in no way showed a greater degree of dilatation or a better definition. Our studies have impressed us more with the "tissue factor" of each individual woman.

Further, the multiparous woman demonstrated dilatation earlier in pregnancy than the primipara. In both parities the right ureter exhibited some degree of hydroureter in every instance. In left-sided and bilateral hydroureter the multiparae showed a greater frequency of dilatation than the primiparae. The more pronounced types of hydroureter were found in the multiparae. We have been impressed with the possible fact that the ureter, like the perineum, having once been dilated, particularly as in pregnancy over a period of many weeks, involutes apparently to normal but in a relaxed state.

The study of the ureter in thirty-six cases, from the ninth to the twenty-fifth postpartum day, reveals the fact that while involution has taken place rapidly in a minority of these cases within these time limits, there still remains a great majority showing right, left, and bilateral dilatation. In fact we have ureterograms of two cases which demonstrate this persistence, in the absence of disease, over periods of twenty-one months and nine years.

## URETERAL DISTORTIONS

Beginning at the sixteenth week the antepartum differed from the postpartum ureter in the abrupt termination of the ureterogram at the level of its entry into the parametrium. On the other hand the

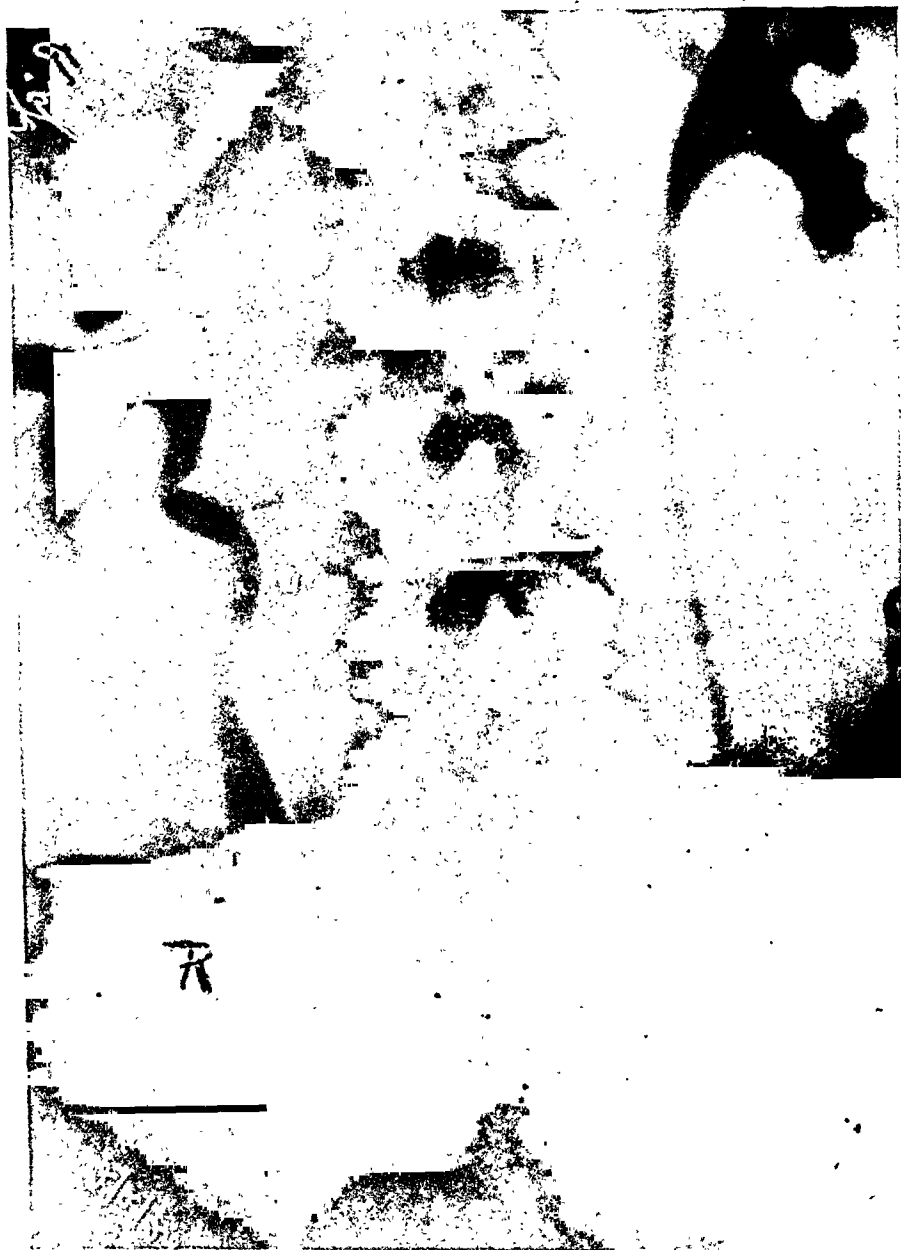


Fig. 3.—Ureteropyelogram, bilateral, in antepartum multipara at the sixteenth week. This shows a marked dilatation and redundancy of the right ureter with a moderate hydronephrosis. Left ureter not dilated. Abbreviation of right ureter again noted.

postpartum ureter could easily be traced to the bladder; in fact, a dilatation of this lower third was in certain instances demonstrated.

Redundancy and kinking of the ureter, while a very definite finding in both antepartum and postpartum cases, was met much more frequently and in greater degrees in the prenatal skiagraphs.

An appreciable stricture revealed itself but once in this whole series of one hundred and fifty-six ureters. This one case was found in the left ureter of a postpartum woman.

The same observation made concerning hydroureter may be largely



Fig. 6.—Ureteropyelogram, bilateral, in antepartum primipara at the twenty-eighth week, showing a dilated right ureter and hydronephrosis. Note the ureteropelvic kink. Note bilateral abbreviation.

applied to hydronephrosis. It begins as early as the sixth week in multiparae and the tenth in primiparae and reaches its maximum at the twenty-fourth week in primiparae and at the twenty-second week in multiparae.

TABLE IV. HYDRONEPHROSIS

	ANTEPARTUM		POSTPARTUM (PER CENT)
	PRIMIPARA (PER CENT)	MULTIPARA (PER CENT)	
Right	93.0	96	72.2
Left	46.2	66	52.7
Bilateral	46.5	62	44.4
No dilatation right	6.6	3	27.7
No dilatation left	53.8	33	47.2

Referring to Table IV, the frequent incidence of hydronephrosis in primigravidae and multigravidae and the postpartum patient is emphasized. The continued predominance of right-sided dilatation is very evident. Left pelvic dilatation, while not quite so frequent in occurrence as left hydroureter, developed in a large proportion of the three groups. The same remarks may be made of the ratio of bilateral dilatation. The escape of the left renal pelvis, to an even greater degree than the left ureter, must be remarked because of the recognized frequency of right-sided pyelitis.

A marked pelvic dilatation on the right side in primiparae was found in 73.2 per cent, in multiparae in 81 per cent, in the postpartum in 55.5 per cent. The same degree of dilatation on the left in primigravidae in 33 per cent, in multigravidae in 40 per cent, in the postpartum in 27 per cent.

Marked hydronephrosis was found much more frequently in the multiparous woman.

While the hydronephroses in our series of antepartum and postpartum women have been well defined and even marked dilatations, in no case have we noted the extreme pelvic distension mentioned by other authors. The largest amount of urine recovered in our series was sixty-seven cubic centimeters, the average being five. Possibly these very much over-dilated renal pelvises reported by others were associated with some degree of infection. Dilatation to the extent of thirty to four hundred and eighty cubic centimeters of urine recovered has been reported by Crabtree. There is a very evident recovery of the pelvic tone early in the period of general postpartum involution. In this survey of the postpartum patient, which extended up to the twenty-fifth day, there is a persistence on the right side of pelvic dilatation in 72.2 per cent and on the left of 52.7 per cent of our cases. An impression derived from this fact, emphasized by Helmholtz,<sup>16</sup> leads us to believe that the dilatation produced in a first pregnancy must have an influence in the production of the greater frequency and the more marked degree of dilatation found in multiparae.

## STASIS

In our investigation of this very important factor in the development of pyelitis, we have a series of twenty antepartum and twenty-six postpartum cases.

Our technic has been that developed by Goldstein.<sup>17</sup> Skiagraphs were taken immediately, and at seven, ten, fifteen, twenty, thirty,



Fig. 7.—Ureteropyelogram, bilateral, in antepartum multipara at the twentieth week, showing very distinctly, bilateral ureteral dilatation with right hydronephrosis. It illustrates the abbreviation at the pelvic brim and also the separation of the ureters.

forty-five and sixty minutes after the instillation of sodium iodide solution into the ureters and renal pelves. In antepartum cases our observations revealed that the left ureter and renal pelvis emptied themselves within the normal limits of seven minutes with double the frequency of the right.

Conversely, it was discovered that, in the actual stasis from the mild degree of fifteen minutes, through the moderate type of thirty min-

utes to the marked group of sixty minutes delay, the right side outnumbered the left in the proportion of four to three.

We would emphasize the fact that, in the class of one hour's stasis, the right side outnumbered the left in the proportion of two to one.

In averaging the time occupied by the two sides in their efforts to empty themselves, we have found that the right side required thirty-seven minutes, the left twenty-nine.



Fig. 8.—Ureteropyelogram, bilateral, of the same patient as shown in Fig. 7. This was taken twenty minutes after the injection of the iodide solution. It shows some emptying.

While ureteral dilatation and hydronephrosis usually appear and reach their maximum relatively early in pregnancy, stasis, however, does not make its appearance until the twentieth week. Whether it is acute or gradual from the onset to the development of an hour's



retention, we are unable to state, not having had the privilege of following a single case from its inception to the termination of gestation. We may state that several of our cases from the twentieth to the twenty-sixth week of pregnancy have shown a delay of one hour; conversely, we have had several instances in women at full term completely emptying the ureters and pelvis in less than thirty minutes.

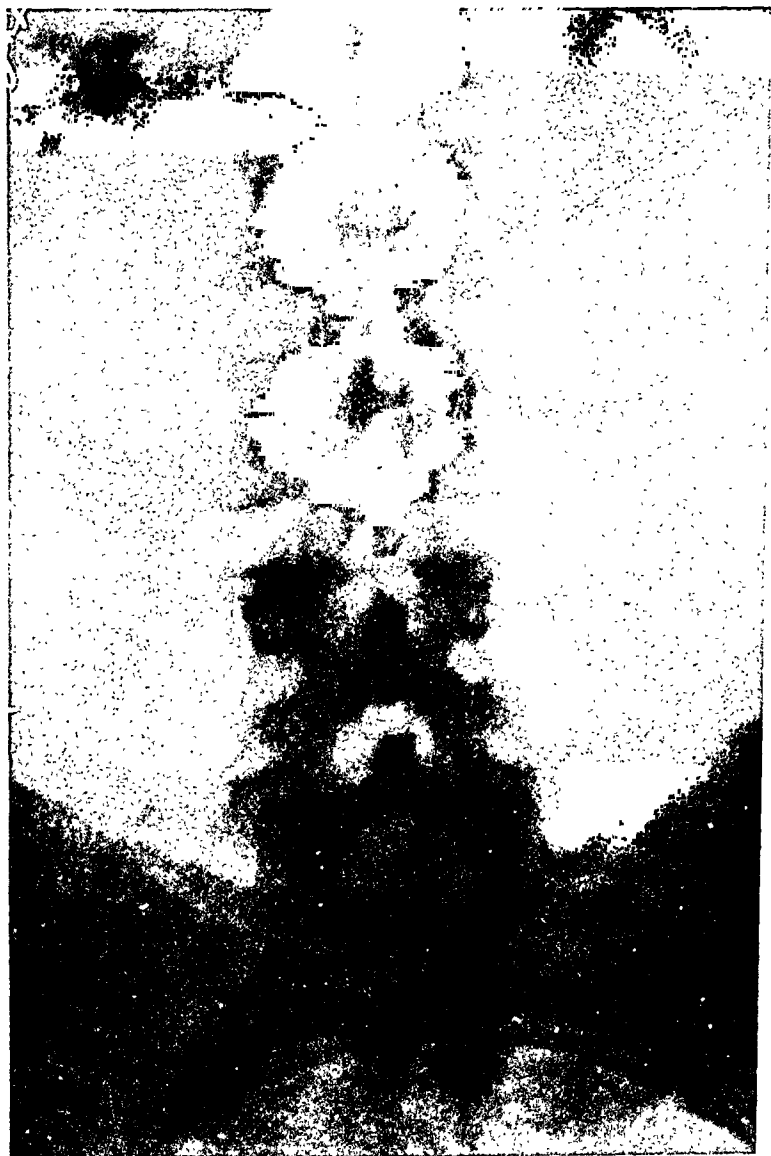


Fig. 9.—This photograph is of the same patient as shown in Figs. 7 and 8. It will be seen that after sixty minutes there is a trace of the iodide solution in the pelvis and ureters.

It has been our experience that the multiparous woman presents more frequent, earlier, and greater degrees of stasis than the primiparous patient.

A comparison of stasis between the antepartum and postpartum series presents striking and interesting differences. The postpartum

patient requires but one-half the average time to empty the renal pelves and ureters completely. There was no appreciable difference in the time demanded by either side. There was no retention beyond forty-five minutes. In fact the majority were completely empty within fifteen minutes. In the antepartum series we found that 30 per cent of

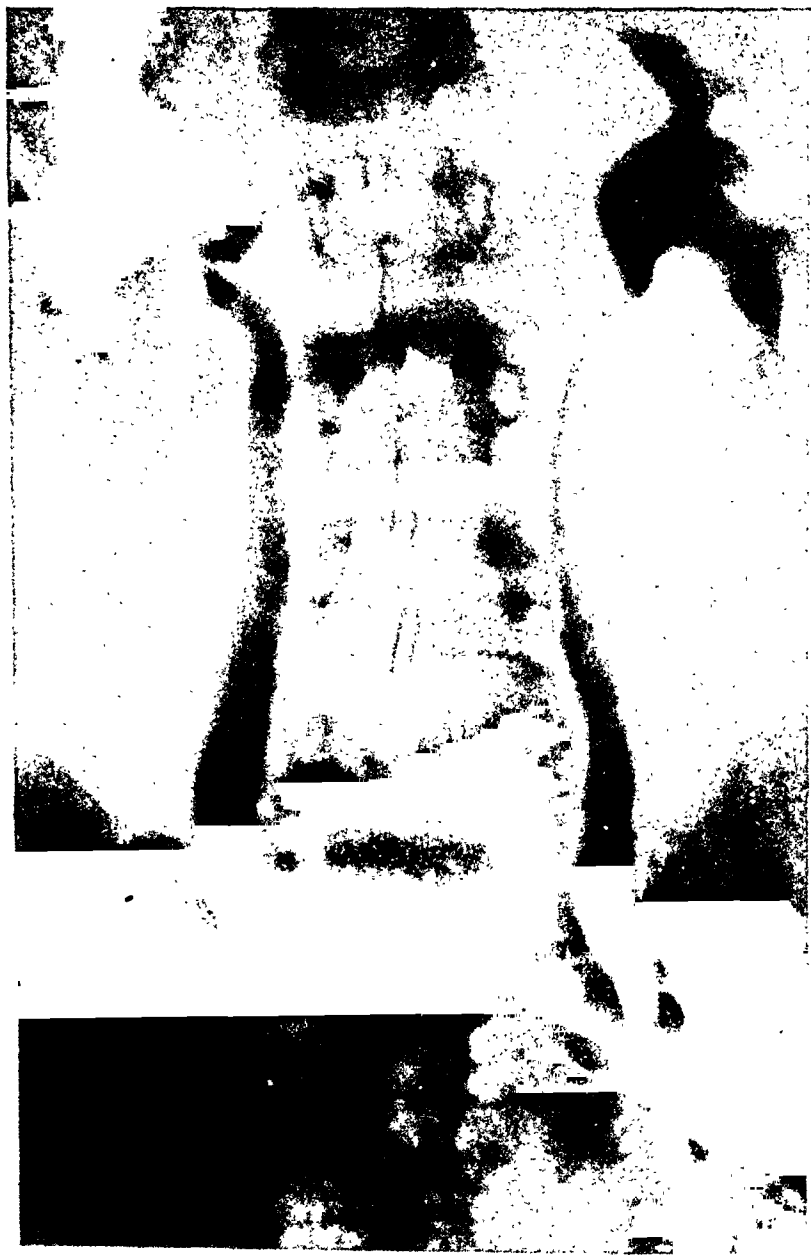


FIG. 10.—Uroteropyelogram, bilateral, in postpartum primipara at the twelfth day. This shows a marked dilatation of the right ureter with redundancy and hydronephrosis. The left ureter is also dilated. Note some degree of dilatation in both lower ureters.

the ureters and pelves emptied themselves within the normal limit of seven minutes, whereas in the postpartum 38 per cent were empty in the same period of time. In the former group but 10 per cent were empty in from seven to twenty minutes whereas in the latter group 42

per cent were evacuated within the same time limit. In the more marked type of stasis from thirty to sixty minutes we have in the prenatal class 60 per cent which showed this great delay. Opposed to this latter figure we have in the postpartum series in the same group but 9 per cent which demonstrated a delay up to and including forty-five minutes.



Fig. 11.—Same patient as shown in Fig. 10. Taken seven minutes later. Shows retention in right ureter, left empty.

There were no postpartum cases showing stasis up to sixty minutes.

The inference to be drawn, we think, from this exhibit is that the uterus and its contents, in spite of DeLee's statement, must play some part in maintaining stasis. All these postpartum skiagraphs were taken at or before the twelfth postpartum day.

One can hardly conceive that the involution of the ureter and its return to the normal tone, peristalsis and drainage within these time

limits could be accomplished so rapidly. In fact unless the trauma of labor produced an edema in the ureter itself, stasis seemed to be relieved greatly following the birth of the child.

An interesting point exhibited by our examination was the apparent complete disappearance of the emphasized abbreviation of the dilated ureter at or near the pelvic brim, noted in the antepartum cases.

The ureter of the postpartum woman, in contradistinction to the

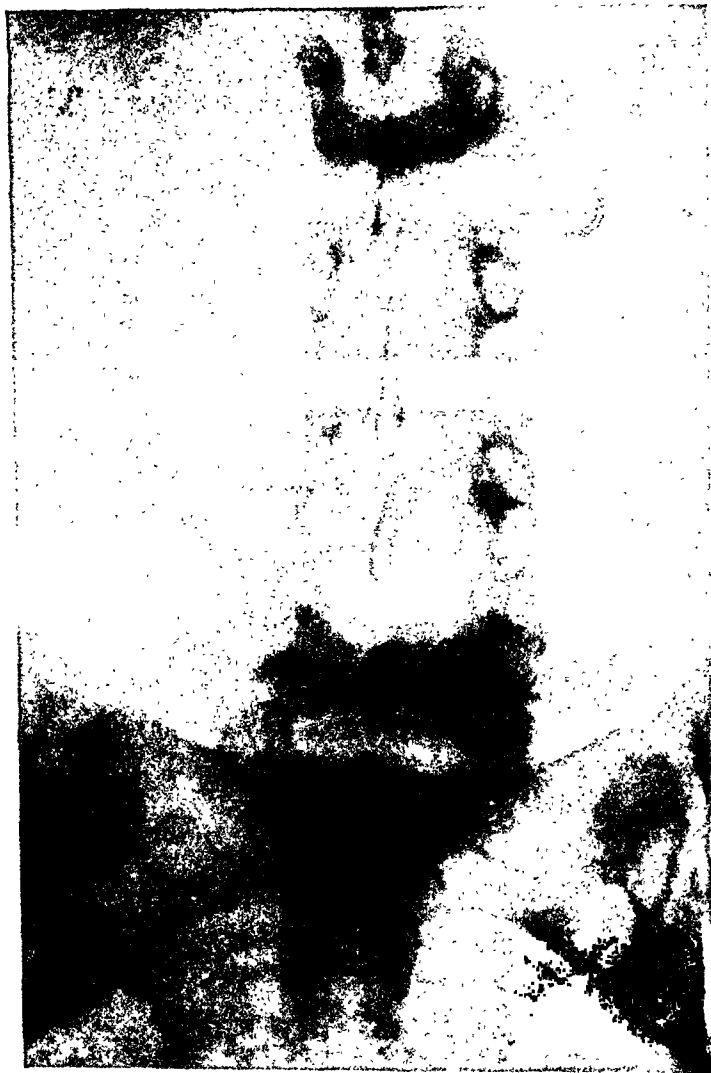


FIG. 12.—Same patient as shown in Fig. 10. Taken fifteen minutes after injection of iodide solution. Both ureters and pelvises empty.

antepartum, shows varying degrees of dilatation of its juxtovesical portion. These findings, we think, confirm in the living subject Carson's conclusions on pressure at the pelvic brim demonstrated on the cadaver.

#### DISCUSSION

Is there an interference with the proper renal and ureteral drainage? We believe that there is. Beginning in the fetus of six months and

in the full-term newborn child, we have found consistently by a histologic study that the ureteropelvic portion of the ureter shows a moderate amount of muscle and fibrous connective tissue, the middle third a less amount, whereas the pelvic and intravesical portions present a more marked degree of the same.

We believe that this reinforcement of the upper third of the ureter is primarily to produce peristalsis but at the same time, perhaps, also to protect the renal pelvis to some degree from regurgitation; the same contention may be applied to the similar occurrence in the lower third, only in a more pronounced manner.

The dilatability of the middle third of the ureter is, up to certain limits, physiologic and only tends to become pathologic, in our opinion, when the musculature of the ureter as a whole becomes atonic.

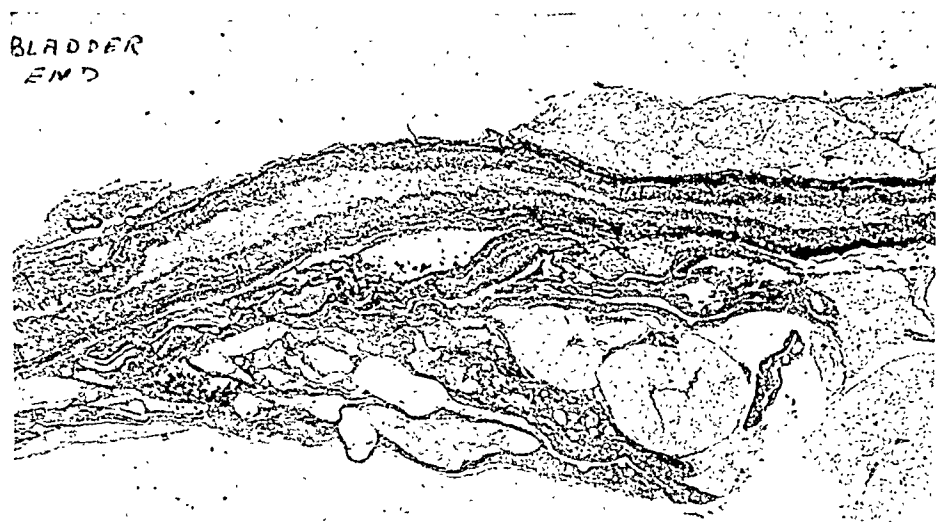


Fig. 13.—The muscle and fibrous connective tissue reinforcement of the juxtovesical portion of the ureter of a fetus of six months' pregnancy is demonstrated. The physiologic dilatation of the middle third is also shown.

Many authors have described the lower third of the ureter in detail; the established fact of the presence of a much greater amount of muscle and fibrous connective tissue in this part of the organ is accepted by all. In his recent and most interesting monograph, Hofbauer has demonstrated in pregnant women an increase in the muscle and fibrous tissue of the whole ureter, but more particularly in the juxtovesical and intravesical portions. While one is prepared to accede some responsibility for the actual development of hydroureter and hydronephrosis in pregnancy to this hyperplasia and hypertrophy, it would seem impossible to concede to it, according to Hofbauer's interpretation, the position of the greatest factor in the development of these conditions.

We prefer to interpret this hypertrophy and hyperplasia as one of physiologic development, for the purpose of protection and of adding to the ureter a greater power to accomplish successfully a larger amount of work.

Graves and Davidoff<sup>18</sup> by their experiments upon the peristaltic action of the ureter have exhibited the fact that the pacemaker for peristalsis in the ureter really lies in the pelvis of the kidney, where a definite head of pressure is maintained. In so far as the upper third of the ureter maintains the same rate and strength in the peristaltic wave and the lower third harmonizes by forcing the urine into the bladder, this head of pressure is maintained at an even level.



Fig. 14.—This shows the blood supply of the nonpregnant uterus.

At the instant of obstruction in the ureter this even mechanism is disrupted and there is immediately produced an elevation in the renal head of pressure, with a consequent increased amount of tension in the walls of the renal pelvis and the ureter itself. Crabtree reports a rise of from five to seventy-five millimeters of mercury in the renal pelvis in one hour in complete obstruction.

The primary result of beginning obstruction in the ureter is a physiologic dilatation. Depending upon the character of the muscle and fibrous connective tissue, which develop an immediate hypertrophy to meet this new demand, the obstruction will be overcome and the physiologic drainage will continue, or continued overdilatation will result. This, to our minds, will bring about a definite loss of tone in the ureter, which will be reflected upon the renal pelvis. Stasis, such as we have shown, will be the inevitable result. We prefer to consider

the hypertrophy and hyperplasia as described by Hofbauer as a result of primary physiologic overdistension rather than the cause of obstruction.

What, then, may be the factors in pregnancy which are likely to produce some obstruction in the ureters giving rise to a hyperplasia and hypertrophy in these structures.

The first probable factor is an increased vascularity in the cervix and parametrium with its pressure capacity and consequent production of congestion.

Secondly, comes the pressure from the general pelvic overcrowding of the growing uterus, which develops equally and in all dimensions,

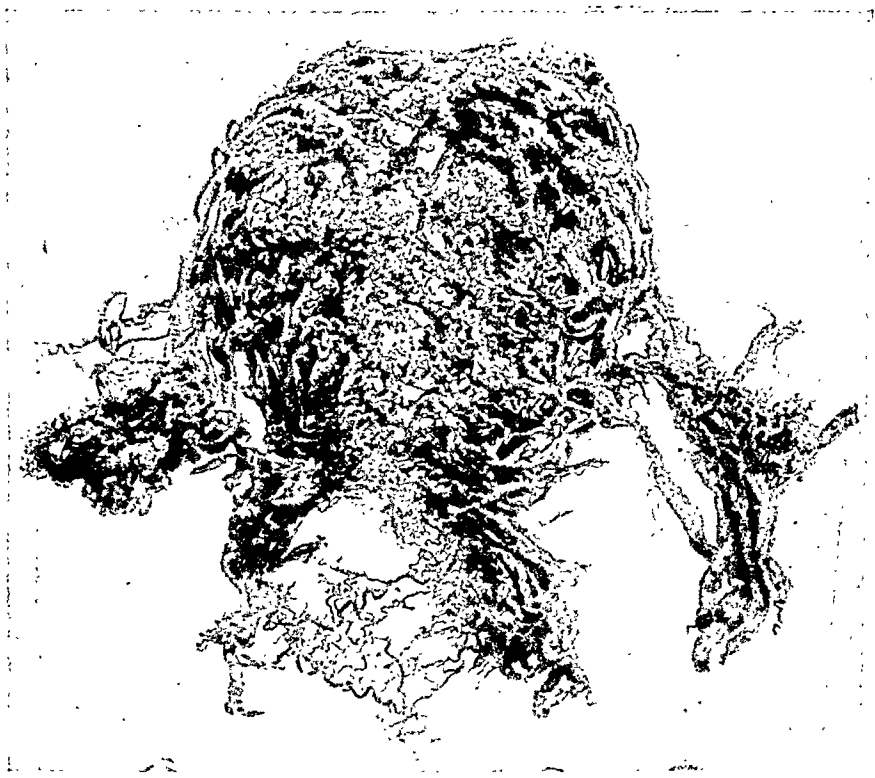


Fig. 15.—This shows the enormous increase in the vascularity of the uterus at eight weeks of pregnancy.

as exhibited upon the bowel, the bladder, and consequently must produce an effect upon the ureters themselves.

Thirdly, a marked congestion and distortion of the vesical trigone.

Finally, the well-recognized dextrorotation of the uterus.

To these combined physiologic forces we believe is due the physiologic hyperplasia and hypertrophy found in the ureter in pregnancy.

In our study, one of the outstanding impressions has been what we have chosen to call "the tissue factor." The variations in ureteral and renal dilatations have not been impressively synchronous with the period of gestation. We have noted as many marked dilatations in the early weeks of pregnancy as in the later months. From this we

conclude that our different cases have developed this peristaltic power of the ureters in varying grades, and consequently demonstrate hydro-ureter and hydronephrosis in different degrees, according to their tissue factors.

### CONCLUSIONS

Physiologic forces external to the ureter cause obstruction to ureteral and renal drainage in pregnancy, which is relieved almost immediately upon the termination of gestation.

2. In pregnancy, there is a constant right-sided ureteral dilatation; while right hydronephrosis is only slightly less frequent.

3. In pregnancy, the left ureter and renal pelvis escape this dilatation in a markedly higher percentage of cases.

4. Bilateral hydroureter and hydronephrosis were of very frequent occurrence.

5. The multiparous woman showed these conditions earlier, more frequently, and in much more marked degree than the primipara.

6. Stasis, as measured by inability of the renal pelvis and ureter to empty themselves within the normal time limits, is a definite and almost universal finding in the antepartum woman. In the postpartum woman it is still persistent, in a lesser degree, over a prolonged period of time.

7. By the demonstration of an unexpected amount of pus and coliform organisms in the bladder and kidney urines of these supposedly healthy pregnant and postpartum women, we believe there is some justification for the use of the term, "a hidden infection."

8. Every pregnant woman has obstruction of some degree, a definite dilatation of the ureters and renal pelvis, with a well-defined stasis. This continues over a long period of time. We have demonstrated in the apparently healthy pregnant and puerperal patient a probable renal complication, the presence of pus and coliform organisms. The line of demarcation between the physiologic and the pathologic in these cases is a very fine one. Trauma and a lowered immunity or resistance are the remaining factors needed.

These women, in our opinion, are all subjects for a possible pyelitis.

We would like in conclusion to express our deep debt of gratitude to Dr. P. J. Kearns of the Pathologic Department and to Dr. W. W. Beattie of the Bacteriologic Department of the Royal Victoria Hospital, Montreal.

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MEDICAL ARTS BUILDING.

## EPIDERMOID CARCINOMA OF THE CERVIX UTERI

### A HISTOLOGIC STUDY TO DETERMINE THE RESEMBLANCE BETWEEN BIOPSY SPECIMENS AND THE PARENT TUMOR OBTAINED BY RADICAL PANHYSTERECTOMY

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SINCE the publication of our observations<sup>1, 2</sup> on the relative malignancy of cancer of the cervix uteri as indicated by the predominate type of cancer cell, efforts have been made by some radiologists particularly Schmitz,<sup>3</sup> Pomeroy and Strauss,<sup>4</sup> Böhm and Zweifel<sup>5</sup> and others to predict from the histologic appearance of biopsy material the predominant type of cancer cell, composing the entire tumor. On such a basis, due consideration being given to the clinical local extent of the disease, these radiologists have felt able to judge of the apparent malignancy of the uterine neoplasm and with a fair degree of accuracy to anticipate the outcome in patients treated by radium.

This study was therefore undertaken to ascertain the degree of resemblance between cancer cells observed in small pieces of tissue obtained for diagnostic purposes and the cancer cells observed in numerous microsections obtained from various portions of the parent tumor.

Such a determination would appear timely since in some clinics radium is being used to the exclusion of surgery for cancer of the cervix uteri. This means that the entire parent tumor no longer becomes available for study while histologic data are obtained from small biopsy specimens.

Also in cases where radium is used as a preoperative measure the appearance of cancer cells is sometimes so altered in the operatively removed uterus that it would appear useful here to know how valuable biopsy material is in reflecting the predominant type of cancer cell composing the parent tumor.

A brief recapitulation may not be amiss to summarize our published work previously referred to. This concerns itself with our demonstration that epidermoid cancers of the cervix uteri can generally be grouped according to the predominant type of cancer cell composing the tumor. We were able, in our previously reported studies, to recognize three fairly distinct cell types in our cancer material. These we designated as the *spinal*, *transitional*, and *spindle* types of cancer cell. As has been previously noted, all combinations of cell types occurred, but irrespective of the occurrence of other cell types we were able to show that the predominant type of cancer cell indicated with a fair degree of accuracy the relative malignancy of the tumor as determined by its invasiveness and its curability by operation. Our findings as compared with those of Broders are summarized in Table I.

TABLE I. PERCENTAGE INCIDENCES OF "FIVE-YEAR OPERATIVE CURES" FOR THE DIFFERENT TYPES OF EPIDERMOID CANCER OF THE CERVIX UTERI

	SPINAL-CELL CANCER (GRADE II OF BRODERS) PER CENT	TRANSITIONAL- CELL CANCER (GRADE III OF BRODERS) PER CENT	SPINDLE-CELL CANCER (GRADE IV OF BRODERS) PER CENT
The Johns Hopkins Hospital (Martzloff)*	47.00	24.2	9.5
The Mayo Clinic (Broders: Per sonal Communication)	53.33	21.5	9.52

\*Martzloff: Johns Hopkins Hosp. Bull., March, 1927, xl, 161.

A brief description of the cancer cells described in our earlier study is as follows:

The *spinal type of cancer cell* resembles the cells seen in the superficial portion of the normal stratified cervical epithelium (Fig. 1, *a*), being polyhedral in shape, with a well-defined cell membrane and a fairly large nucleus. The nucleus assumes only a moderately intense hemotoxylin stain while the cytoplasm which is abundant takes a rather pale eosin coloration (Fig. 2).

The *transitional type of cancer cell* resembles somewhat a more deeply situated group of cells seen in normal cervical epithelium. (Fig. 1, *b*.) The cancer cells have a very faint or indefinite cell membrane while the cytoplasm is less abundant and more deeply staining than in the spinal type of cancer cell. The nuclei take a deep hemotoxylin stain and generally have nucleoli. (Fig. 3.)

The *spindle type of cancer cell* is, as its name implies, spindle-shaped. For the sake of brevity this description will suffice, for it serves to identify the cell type under consideration. (Fig. 4.)

In a more recent study<sup>6, 7</sup> we have shown the factors that apparently govern operability in the various cell types of cancer and have indicated the prognosis that may be anticipated in a group of operative cases from a consideration of the clinical aspects and an adequate study of the pathologic specimens. Table II briefly summarizes these deductions.

TABLE II. SHOWING THE PROGNOSIS THAT MAY BE PREDICTED IN PATIENTS SURVIVING OPERATION WHEN CONSIDERATION IS GIVEN THE FACTORS GOVERNING OPERABILITY AND THE PREDOMINANT TYPE OF CELL COMPOSING THE CANCER

TYPE OF CANCER	NUMBER OF CASES	NO. HISTOLOGICALLY BEYOND SCOPE OF PERMANENT CURE (INOPERABLE)	NUMBER OPERABLE	NUMBER CURED	PER CENT OF OPERABLE CASES CURED
Spinal-cell	30	8	22	14	63.6
Transitional-cell	90	44	46	18* (22)	39.1* (47.8)
Spindle-cell	17	10	7	1	14.0
Total for epidermoid cancers	137	62	75	33 (37)	44.0 (49.3)
Adenocarcinoma	9	5	4	3	75.0
Total	146	67	79	36 (40)	45.5 (50.0)

\*To this number might well be added four other patients who were operable and died or were lost 7, 8 and, in two instances, 10 years after operation without evidence of recurrence. This would then yield the results indicated by the figures in parentheses.

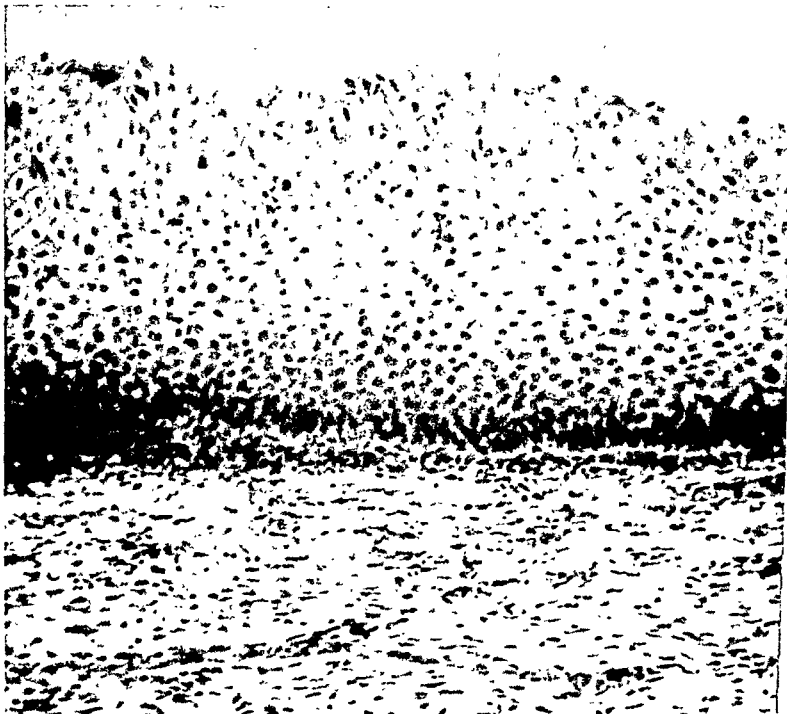


Fig. 1.—Normal cervical epithelium. At *a* are the so-called spinal cells with distinct cell membranes and abundant pale eosin staining cytoplasm. At *b* are the so-called transitional cells where no distinct cell membrane is seen, the cytoplasm is less abundant and all portions of the cell take a deeper stain.

If one wishes to apply the above data to the pathologic evidence obtained from biopsy material, it then appears essential to know as a minimal requirement how valuable biopsy material may be in its ability to reflect the cytomorphology of the parent tumor.

For the purpose of this study we have 70 specimens removed from patients who were on the gynecologic service of the Johns Hopkins Hospital. All of these patients had unmistakable cancer of the cervix

uteri. In each instance tissue was removed from the cervix either several days prior or immediately preceding the major operative procedure. The local removal of tissue was followed by immediate radical cauterization of the cervix in practically every patient.

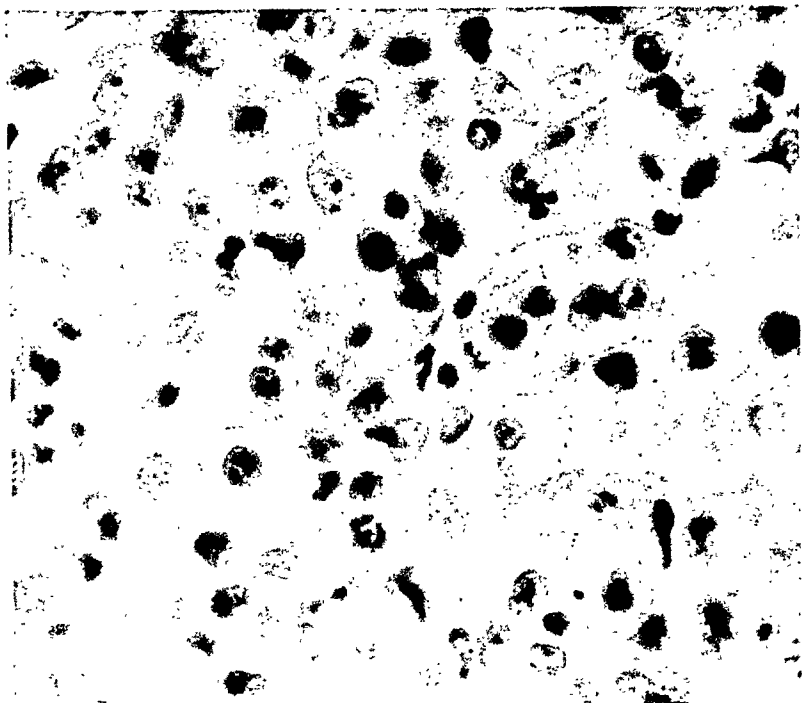


Fig. 2.—Spinal-cell cancer.

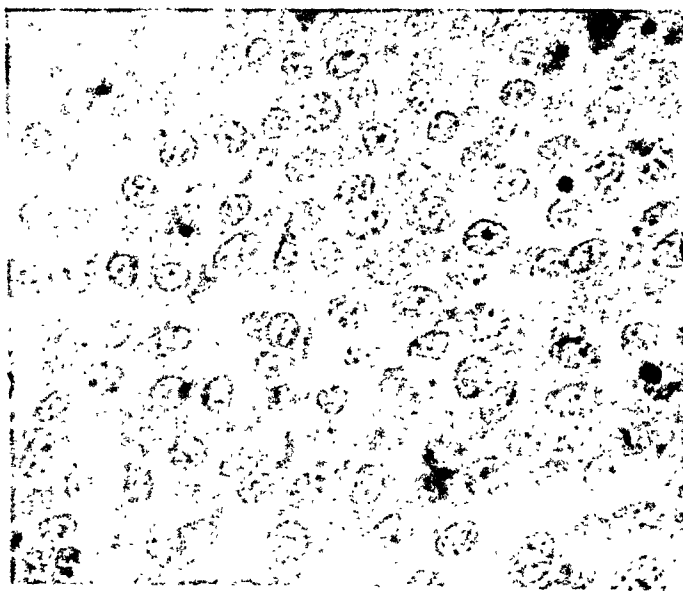


Fig. 3.—Transitional-cell cancer.

As in our previous publications we are again designating these cancers by the predominating variety of cancer cell; viz., the transitional-cell, spinal-cell and spindle-cell groups. In addition, for this study, we have segregated a fourth group in which the spinal and

transitional cancer cells occur in about equal proportions. This latter group in previous reports has been incorporated with the transitional-cell group in order to simplify what might otherwise have become a cumbersome division of material and, I might add, has served to swell the number of cures in the transitional-cell type of cancer.

Under the four above-mentioned groups the biopsy material and the corresponding parent tumor have been compared as to their content of various cell types, the occurrence or absence of epithelial pearls,

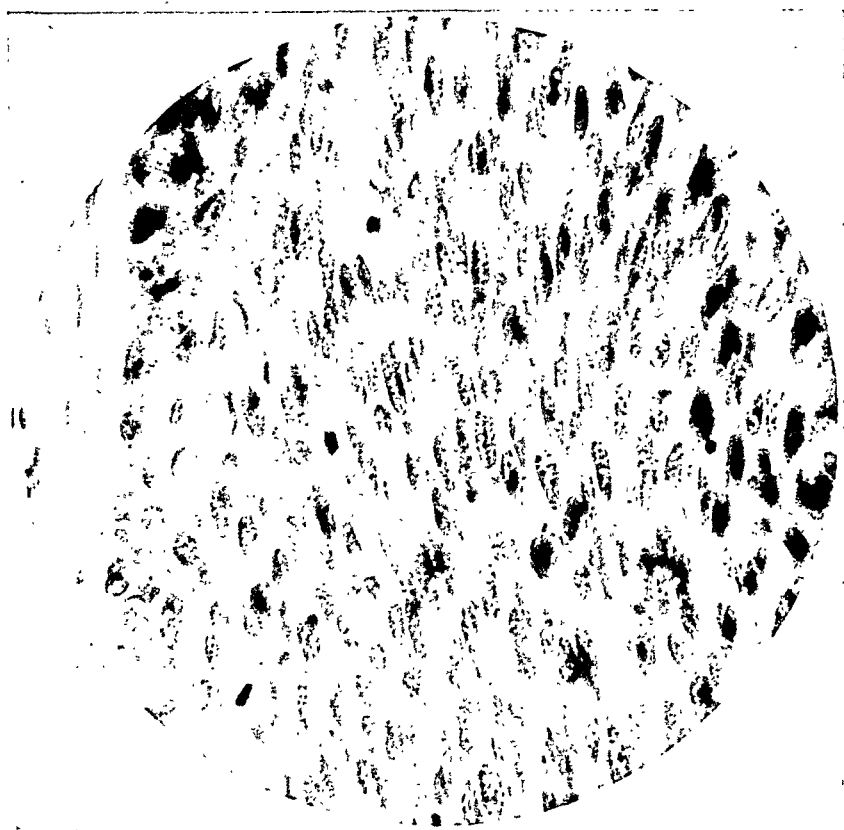


Fig. 4.—Spindle-cell cancer.

giant cells, nucleoli, and mitotic figures. Finally the general histologic pattern was compared where sufficient tissue was present in the biopsy material to warrant such a contrast.

#### TRANSITIONAL-CELL CANCER

For our present study 43 specimens of transitional-cell cancer were available. As we have previously reported, cancers in which this type of cancer cell is the predominating variety formed the great majority of malignant cervical neoplasms encountered.

It will become apparent in the analysis of this material that while the transitional cell is the predominant variety, both the spinal- and spindle-cell types of cancer cells commonly occur with varying frequency. It would lead too far afield and afford complex data of ques-

tionable value for this particular study to enumerate for these or the following groups of tumors the incidence with which other varieties of cells occur in noteworthy numbers. However, merely for illustration it can be said that of the 43 cases in this group 32 (74.8 per cent)

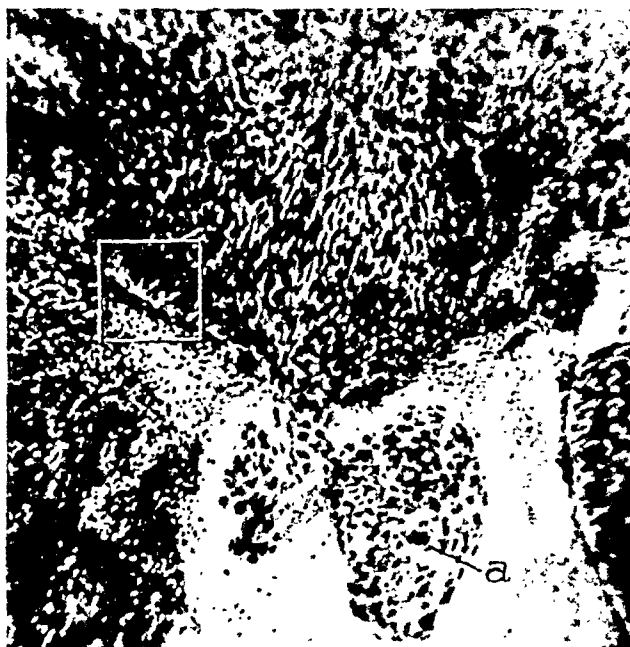


Fig. 5.—(Gyn. Path. No. 27069.) Biopsy showing predominance of spindle type of cancer cell. At *a* is a multinuclear giant cell.

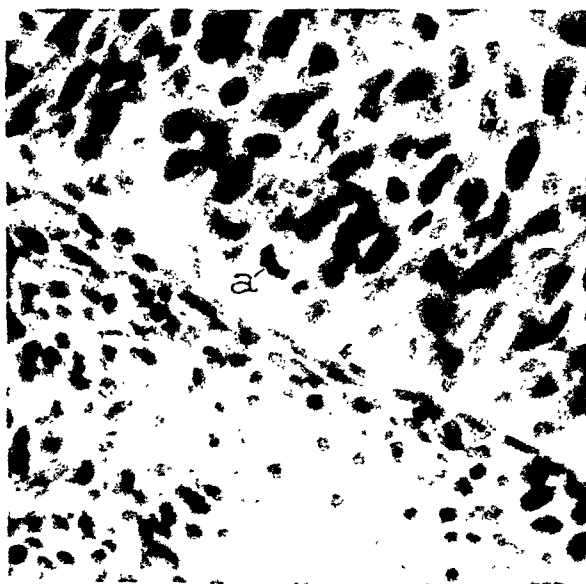


Fig. 6.—(Gyn. Path. No. 27069.) High power view of blocked area in Fig. 1. At *a* is a mitotic figure and elsewhere there are round and oval cells verging on spindle shape. From such an area no conclusion can be drawn as to the predominant type of cancer cell.

showed the spindle type of cancer cell in sufficient number to make it a factor in the histologic picture. In instances where cancer alveoli showed occasional peripherally situated spindle cells in numbers so

small as hardly to influence the histologic panorama, their occurrence was not noted. Had notation been made of these then the above incidence would be entirely too small. The same may be said for the occurrence of spindle cells in association with spinal-cell cancer, though here the generalization cannot be so sweeping. On the other hand no such generalization can be made for the association of spinal cells in tumors predominately of the transitional-cell type. Here we found typical spinal cells in 17 instances (39.5 per cent) while in 7 more specimens cells occurred that could questionably be classified as spinal cells. In the later specimens these cells had in many areas the

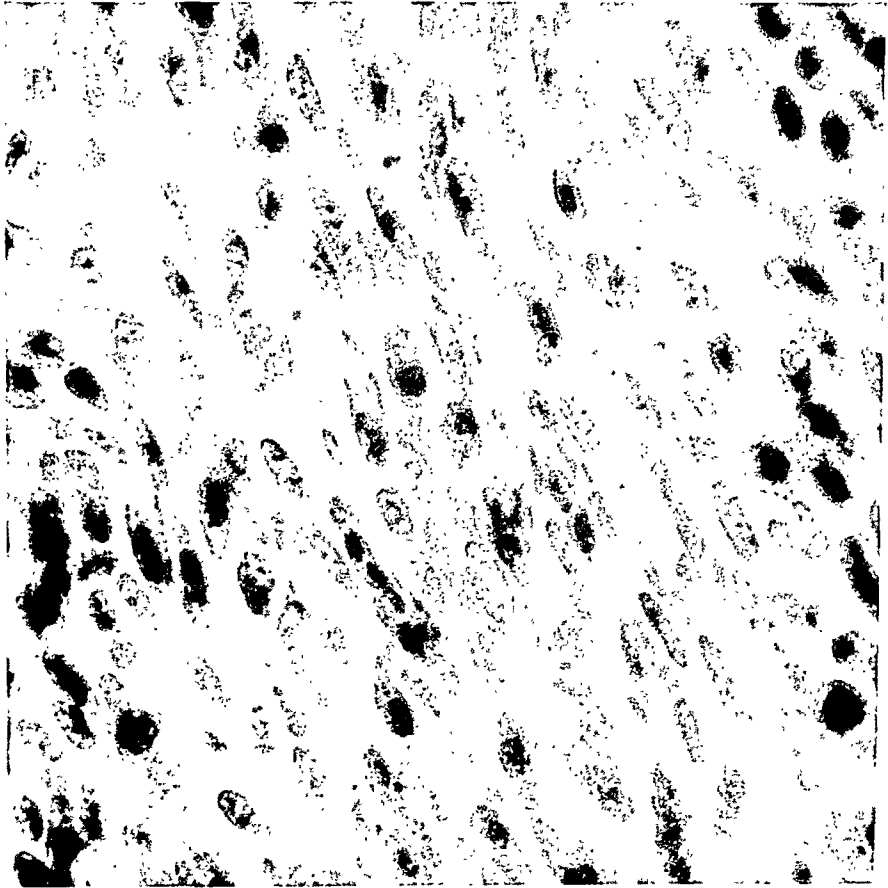


Fig. 7.—(Gyn. Path. No. 27069.) High power view of area to the right of blocked area in Fig. 5. This shows rather typical spindle-shaped cells which form the predominant cell in both the biopsy and parent tumors. See Fig. 4, etc.

general shape, the familiar relation between cytoplasm and nucleus and tinctorial properties suggestive of typical spinal cells. A distinct cell membrane, however, was absent. From cells of this appearance to those regarded as typical transitional cells every intermediate gradation may be seen. In this as in previous studies all cells not typical of the spinal- or spindle-cell varieties were classed as transitional cells. In this manner the well-nigh hopeless task was avoided of trying to classify an endless variety of cells possessing slight morphologic or tinctorial differences.

In comparing the histologic picture presented by biopsy material and numerous microsections of the parent tumor obtained by operation, we observed 13 (30.2 per cent of 43) instances in which the biopsy did

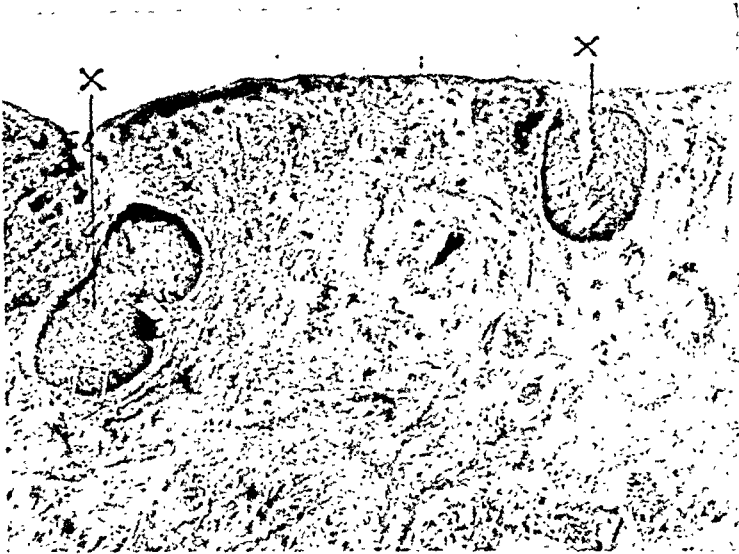


Fig. 8.—(Gyn. Path. No. 27099.) This is from the parent tumor of which Gyn. Path. No. 27069 is the biopsy. Low power of typical cancer alveoli at X. These are composed in most part of spindle cells.

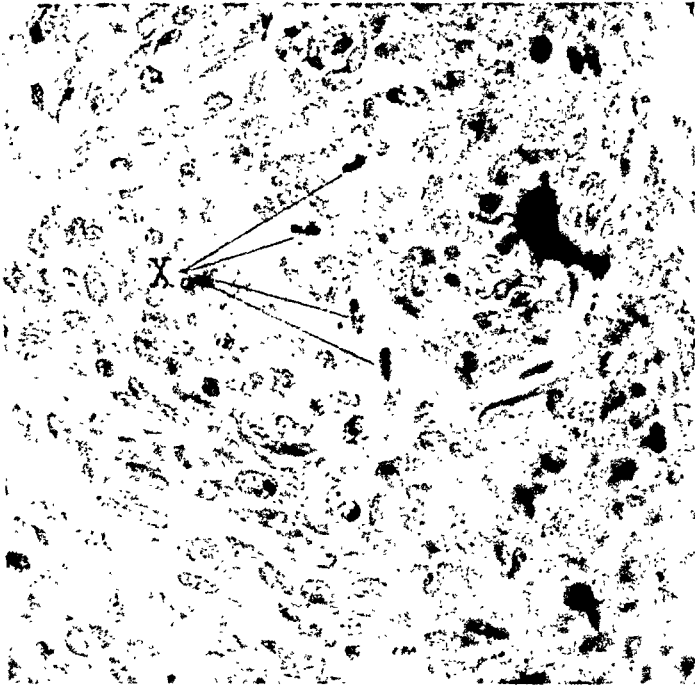


Fig. 9.—(Gyn. Path. No. 27099.) Higher power of blocked area in Fig. 8. This shows both round- and spindle-shaped cells and from an area as this a determination of the predominant type of cancer cell is impossible. Mitotic figures are seen at X.

not reflect the cytomorphology of the parent tumor. This is brought out in Table III.

From the foregoing it is evident that in 4 instances the biopsy findings clearly and erroneously indicated a tumor of the spindle-cell variety. In 9 other instances it was impossible to distinctly define a



predominant variety of cancer cell, though in each instance the parent tumor was composed of cancer cells predominantly of the transitional-cell type.

TABLE III. TRANSITIONAL-CELL CANCER (43 CASES)

Biopsy showing predominance of spindle cancer cells	4 specimens
Biopsy showing equal number of transitional and spindle cancer cells	5 specimens
Biopsy showing predominance of spinal cancer cells	0 specimen
Biopsy showing equal number of transitional and spinal cancer cells	4 specimens

Table III does not consider the occurrence of epithelial pearls, mitoses, giant cells, or nucleoli. These have been considered separately in order

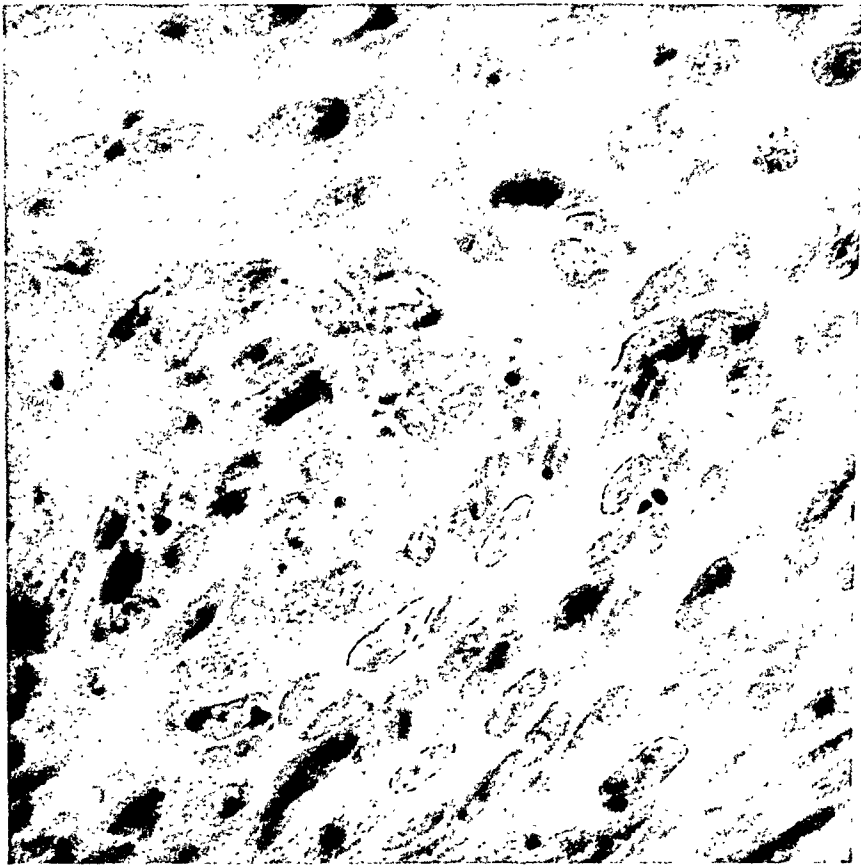


Fig. 10.—(Gyn. Path. No. 27099.) High power from another area in cancer alveolus seen in Fig. 8. These spindle cells form the predominant type of cancer cell in both the biopsy and parent tumors of this specimen which is classed as a spindle-cell cancer.

better to evaluate the degree of similarity existing between biopsy material and the parent tumor.

*Epithelial pearls* were encountered in 8 of the 43 cases of transitional-cell cancer as shown in Table IV.

TABLE IV. SHOWING DISTRIBUTION OF EPITHELIAL PEARLS IN EIGHT CASES OF TRANSITIONAL-CELL CANCER

NUMBER OF CASES			
Biopsy	}	4	0
Parent tumor		3	1

From the foregoing it is seen that in only half of the cases showing epithelial pearls did the biopsy and parent tumor correspond in this particular observation.

*Mitotic figures* were noted in the biopsy material and parent tumor of every specimen. As evidence of mitosis we accepted only nuclear changes characterizing the metaphase or anaphase of the karyokinetic cycle. Not infrequently the telophase could be readily identified where other mitoses were numerous but by itself we did not consider this appearance sufficiently characteristic for identification in ordinary micro

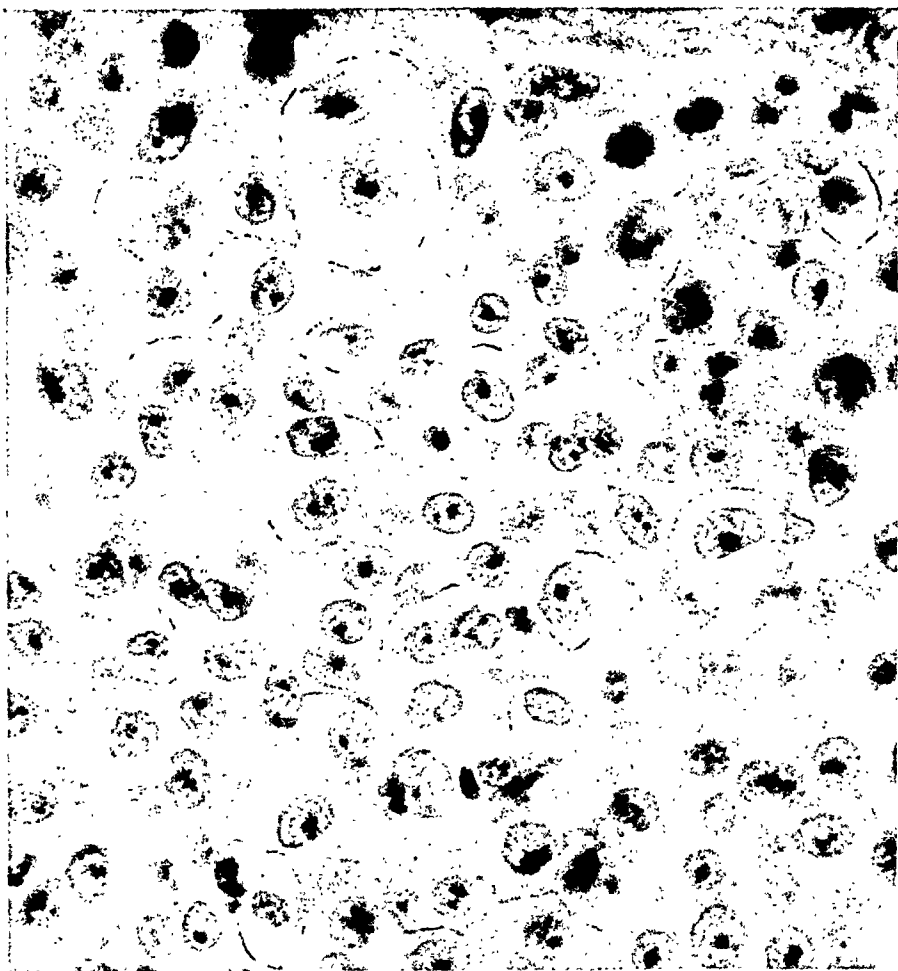


Fig. 11.—(Gyn. Path. No. 26737.) Biopsy material showing spinal type of cancer cells. The cell membranes do not come out well so that some retouching has been necessary. Compare with Fig. 12. Other areas show transitional-cell types in about equal numbers so that from the biopsy it is impossible to decide as to the predominant type of cancer cell.

sections. Possibly what we have termed the metaphase may be a stage in the prophase. However, we did not construe an irregularly rounded, pyknotic nucleus as definite evidence of mitosis obvious as this might be to the experienced observer.

*Giant cells* either mono- or polynuclear were observed in 25 of these 43 cases. In only 5 instances did the biopsy and parent tumor material fail to correspond in this detail.

*Nucleoli* were observed in all but five specimens. In two of these the absence of nucleoli occurred in both biopsy and parent tumor material while in the remaining 3 was there lack of similarity.

#### SPINAL-CELL CANCER

In the group of cancers where the spinal type of cancer cell predominates we have only 6 cases where biopsy material was available

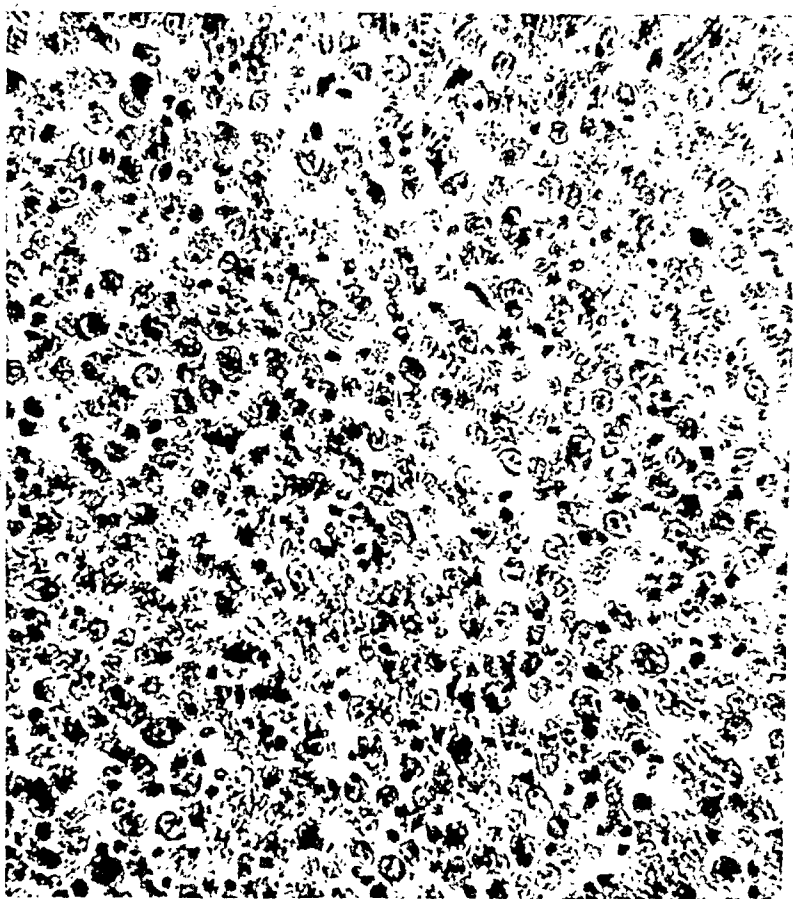


Fig. 12.—(Gyn. Path. No. 26800.) Section from parent tumor of which Fig. 11 represents the biopsy. Cells are practically all of the transitional-cell type, no definite spinal cells being seen in sections of the parent tumor.

for comparison with tissue from the parent tumor. Table V illustrates clearly the situation encountered in comparing the predominant cell types in biopsy and parent tumor material.

TABLE V. SPINAL-CELL CANCER (6 CASES)

Biopsy showing predominance of spindle cancer cells	0 specimen
Biopsy showing equal number of spinal and spindle cancer cells	0 specimen
Biopsy showing predominance of transitional cancer cells	1 specimen
Biopsy showing equal number of spinal and transitional cancer cells	2 specimens

Deductions obtained from such a small number of specimens may be manifestly erroneous. However, it is seen that in one instance the biopsy indicated incorrectly the presence of a transitional-cell cancer while in two instances a definite decision could not be made as to the predominate type of cancer cell.

*Epithelial pearls* were noted in 3 specimens. In one they were observed in both biopsy and parent tumor, in one in the biopsy and in the third solely in the parent tumor.

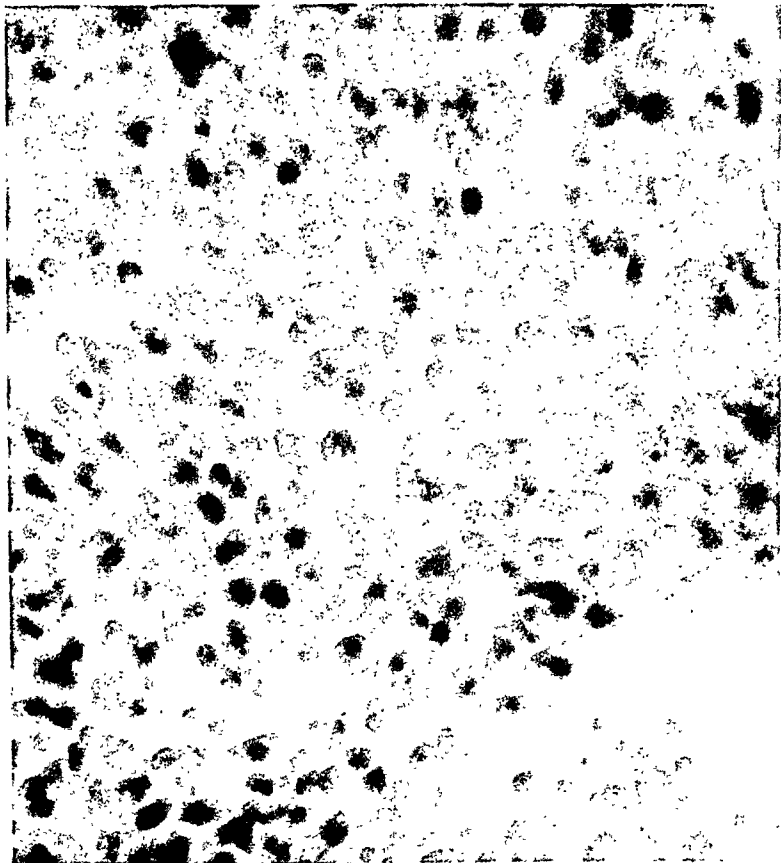


Fig. 13.—(Gyn. Path. No. 26657.) Biopsy material showing a predominance of the transitional type of cancer cell. Compare with Fig. 14.

*Mitoses* were observed in both biopsy material and the tissue from the parent tumor in every instance.

*Giant cells* occurred in 5 of the 6 specimens as shown in Table VI.

TABLE VI. SHOWING DISTRIBUTION OF GIANT CELLS IN FIVE CASES OF SPINAL-CELL CANCER

		NUMBER OF CASES		
Biopsy	{	1	1	0
Parent tumor			0	3

*Nucleoli* were uniformly present in biopsy and parent tumor preparations.

SPINDLE-CELL CANCER

For this study 11 specimens were available. In Table VII are tabulated the biopsy findings in 4 specimens where though the parent tumor is predominately composed of the spindle type of cancer cell, the biopsy findings are equivocal or misleading. In the remaining 7 specimens the parent tumor confirms the biopsy.

It is seen from Table VII that in 4 specimens (36.4 per cent of 11) the biopsy material did not reflect the predominant cell type of the

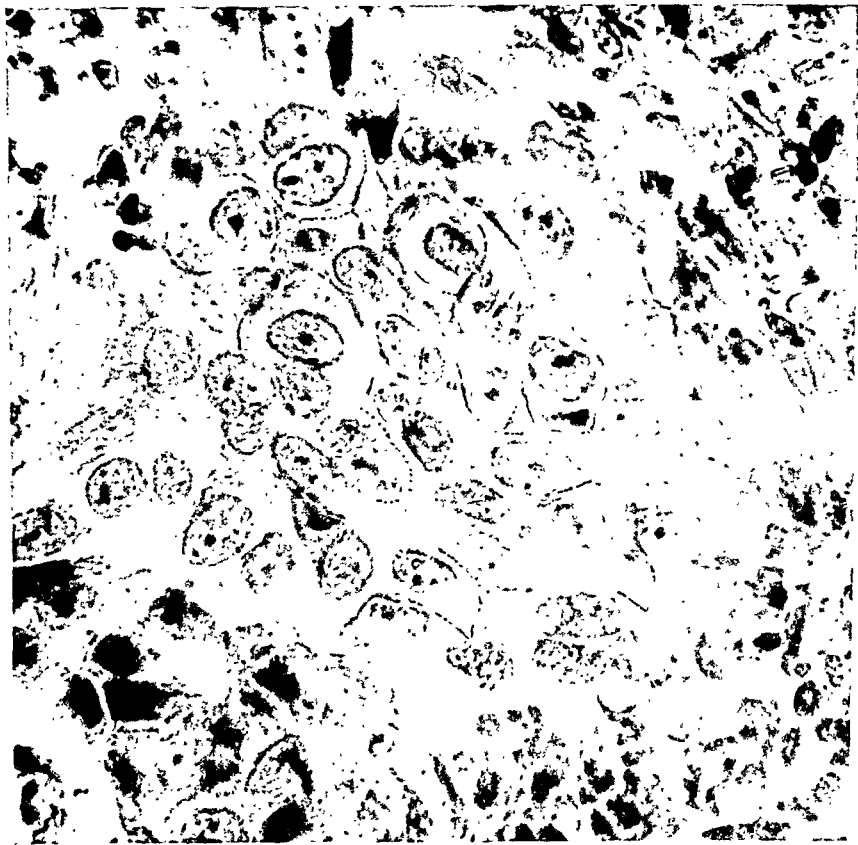


Fig. 14.—(Gyn. Path. No. 26657.) Section of parent tumor of which Fig. 13 represents the biopsy material. This section shows a predominance of the spinal type of cancer cell which is the predominant cell type throughout the tumor. Retouching necessary to bring out cell membranes in photograph.

parent tumor. In fact, in 3 of these specimens the biopsy indicated a pure transitional-cell type of cancer, for no spindle cells were seen in this material.

TABLE VII. SPINDLE-CELL CANCER (11 CASES)

Biopsy showing predominance of transitional cancer cells	3 specimens
Biopsy showing equal number of spindle and transitional cancer cells	1 specimen
Biopsy showing predominance of spinal cancer cells	0 specimen
Biopsy showing equal number of spindle and spinal cancer cells	0 specimen

One other case, not included in Table VII requires mention. In this instance the biopsy revealed an overwhelming number of spindle cells while study of the parent tumor showed about an equal inci-

dence of spindle and transitional cells. Because of the biopsy finding this case was included in the spindle-cell group of cancers.

*Epithelial pearls* were observed in one case occurring in both the biopsy material and the parent tumor. The biopsy in this instance accurately reflected the histologic appearance of the parent tumor in all other respects.

*Mitotic figures* were observed in every instance in both biopsy material and parent tumor.

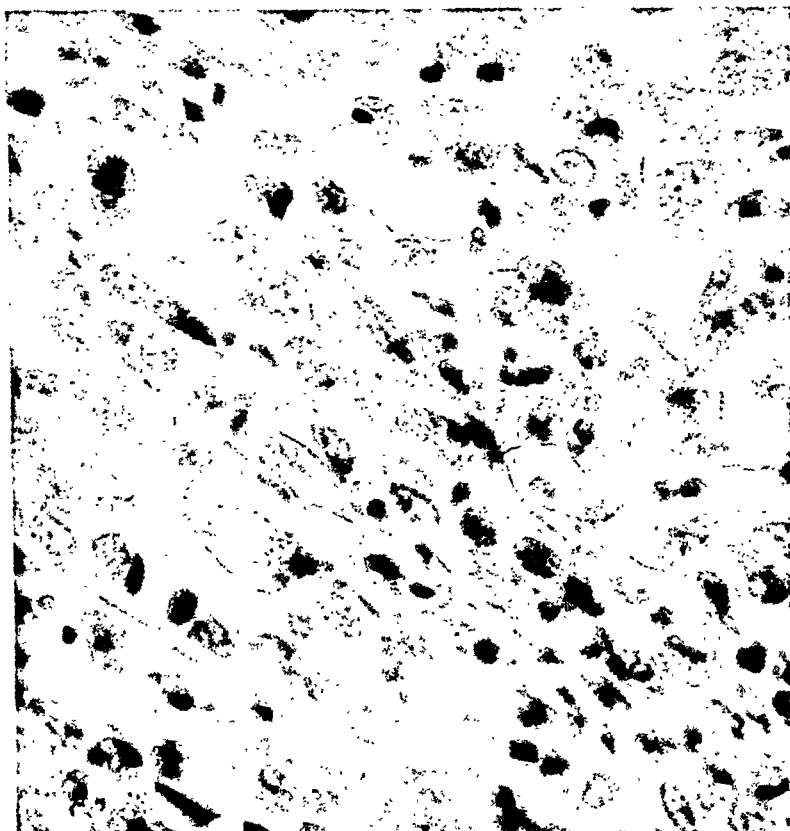


Fig. 15.—(Gyn. Path. No. 27098.) Biopsy showing spinal type of cancer cell in pre-dominance. Compare with Fig. 16.

Giant cells both mono- and polynuclear were observed in 6 of these 11 specimens. In this respect the biopsy material indicated their presence in the parent tumor.

*Nucleoli* were observed in all but two biopsy specimens. The parent tumor in one of these showed no nucleoli while in the other specimen they were present.

#### SPINAL- AND TRANSITIONAL-CELL CANCER

In this group are included 10 specimens in which spinal- and transitional-cell types occurred in equal proportion in the parent tumor. It may be noted that spindle-cell types were also noted in some of these specimens but in such small numbers as hardly to influence the histologic picture.

In Table VIII are tabulated the biopsy findings in so far as cell type is concerned in these 10 specimens.

TABLE VIII. TRANSITIONAL AND SPINAL CANCER CELLS OCCURRING IN EQUAL NUMBERS (10 CASES)

Biopsy showing a predominance of transitional cancer cells	4 specimens
Biopsy showing equal number of spinal and transitional cancer cells	6 specimens
Biopsy showing predominance of spinal cancer cells	0 specimen

From the foregoing it is seen that the biopsy material indicated a predominance of transitional cells in 4 (40 per cent) of the 10 specimens while in the remaining 6 the biopsy findings corresponded to the parent histology.

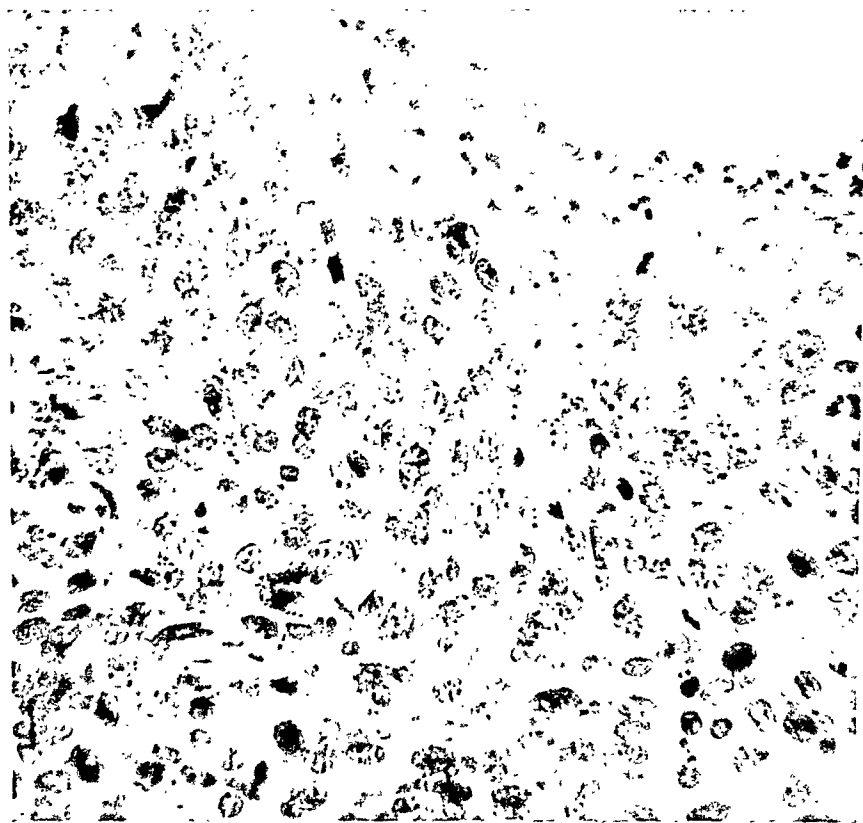


Fig. 16.—(Gyn. Path. No. 27124.) Section of parent tumor of which Fig. 15 represents the biopsy. The cells in this section resemble most nearly the transitional-cell type and are characteristic of the entire tumor. A moderate number of spindle-cells are present. (2099 mc. hours radium five days preoperatively.)

*Epithelial pearls* occurred in 3 specimens. In one both biopsy material and parent tumor contained pearls while in the other two their occurrence was confined to the parent tumor, none being found in the biopsy tissue.

*Mitoses and nucleoli* were noted in both biopsy material and sections of the parent tumor of every specimen.

*Giant cells* were seen in all parent tumors and in all but two of the biopsy specimens.

## SUMMARY

This study is based on 70 specimens of cancer of the cervix uteri obtained by operation at the Johns Hopkins Hospital. In each instance biopsy material was available for comparison with the histology of the parent tumor. The object of this study is to ascertain to what extent the cytomorphology of the biopsy material reflects the histologic picture of the parent tumor in so far as the predominating type of cancer cell is concerned.

In 43 specimens of *transitional-cell cancer*, study of the biopsy material revealed in 13 (30.2 per cent) instances a histologic picture that did not satisfactorily reflect the cytomorphology of the parent tumor. In 4 of these 13 specimens the biopsy material erroneously indicated a spindle-cell type of cancer and in the 9 remaining specimens it was impossible to define a predominant variety of cancer cell.

In 6 specimens of *spinal-cell cancer* it was impossible from a study of the biopsy material to definitely determine the predominant type in 3 (50 per cent). In one of these the biopsy incorrectly indicated a transitional-cell cancer.

There were 11 specimens of spindle-cell cancer available for study. In 4 of these (36.4 per cent of 11) the biopsy material did not indicate the predominant cell type of the parent tumor.

In the group of cancers where the *spinal- and transitional-cell types* occurred in about equal proportion it was found that the biopsy material in 4 (40 per cent) of the 10 specimens available for study did not bear out the findings in the parent tumor in that they indicated a predominance of transitional cells.

Observations were made on the occurrence of epithelial pearls, mitoses, nucleoli and giant cells in both biopsy and parent tumor material.

## CONCLUSION

From the foregoing observations it is permissible to conclude that in carcinoma of the cervix uteri, a study of biopsy material will, in about one-third of the material studied, fail to indicate correctly the predominate variety of cancer cell in the parent tumor.

Therefore, any studies having biopsy material as their sole basis that attempt to offer a prognosis based on the predominant type of cancer cell in cancer of the cervix uteri, face the problem of inaccuracy as stated in the preceding paragraph.

To Doctor Cullen are due my appreciation and thanks for his ever ready interest, helpful criticism, and the privilege of making this as well as previous studies.



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## END-RESULTS OF THE TREATMENT OF CERVICAL CANCER BY RADIATION THERAPY

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(From the Memorial Hospital)

RECENTLY, in reviewing the cases of carcinoma of the cervix which had been accepted for treatment in 1922 and 1923 on the gynecologic service at the Memorial Hospital, an effort was made to group the cases not only from the standpoint of clinical stage of the disease present when first seen but also from the histologic standpoint of degree of anaplasia in the biopsy specimens obtained from the tumors.

Certain conclusions were reached from this study which it seemed worth while to present for consideration.

Before taking up this part of our subject, I would like to make a report on the present status of the cases treated by Dr. Harold Bailey at the Memorial Hospital previous to December 31, 1921.

TABLE I. CASES TREATED BY RADIUM THERAPY, 1918 TO 1921 INCLUSIVE,  
SERVICE OF DR. HAROLD BAILEY

CERVIX	TOTAL	APRIL 1, 1928	PER CENT ALIVE 6-9 YEARS
Early	35	9	25.7
Borderline	52	7	13.4
Advanced	288	16	5.5
Recurrent	139	16	11.5

We have included no cases treated before January 1, 1918, as only small amounts of radium were available, no definite plan of treatment was being followed, and the work was really in an experimental stage. By 1918 a definite plan was established, consisting of crossfiring the lesion with vaginal and cervical applicators, bare seeds imbedded in the lesion, and radium block applied in six positions about the pelvic girdle. Radium alone was used in all these treatments.

A review of these figures would indicate that early diagnosis still remains the most important factor in the ultimate prognosis.

Is it fair to assume that all these patients will remain free from a return of their disease? I think not. We have now under treatment

one of Bailey's 1919 patients who remained symptom free for eight years, then began to complain of "rheumatism" in the left leg. Examination reveals hard, nodular, metastatic masses in the left parametrium, and in the retroperitoneal lymphatic glands, anterior to the sacrum. Skiagraph of the pelvis shows cancerous invasion of the left ilium, inner wall on either side of the brim of the true pelvis, extending down into the acetabulum and well up into the body of the ilium.

Several other patients remained well for five or more years before disappearing from our records, and they are counted as dead. Of course many of these patients are advanced in years and could readily be carried away by other diseases so that we must expect a normal loss from this source. In our experience it is quite unusual to find a late recurrence in the cervix at the original site of the disease.

Such recurrences are usually in the distant parametrial and iliac lymph glands. Their presence is indicated by deep-seated obscure pain long before any gross lesion can be identified. One of the most obscure cases of recurrence I have had was associated with persistent deep-seated pain to the left of the spine midway between the umbilicus and the left costal margin. The pain became so intense that it required hypodermic medication and was present for a year before a tumor mass could be recognized. In the meantime careful roentgenographic studies had been made of the ribs, spine and pelvis, of the kidneys, gall bladder, stomach, and intestines to no avail.

My personal reaction to such a situation is that exploratory celiotomy is justified after the usual precautions to avoid an error in diagnosis. It may be quite possible to locate the metastatic lesion and to infiltrate it with gold seeds to the benefit of the patient.

In 1922 and 1923 there were 224 cases of carcinoma of the cervix admitted for treatment.

We first grouped the cases according to the clinical stage of the disease and the number of cases still alive.

TABLE II. EFFECT OF CLINICAL STAGE UPON PROGNOSIS

CLINICAL STAGE	NO. OF CASES	ALIVE	PER CENT ALIVE
Early	28	17	60
Borderline	35	13	37
Advanced	161	37	23

It is evident from Table II that early diagnosis is a most important factor in prognosis.

The slides of all the cases were then carefully studied from the histologic standpoint by Dr. Max Cutler, with the advice and cooperation of Dr. James Ewing. Twenty-four of the cases were eliminated because of unsatisfactory slides for study or grading, leaving 200 cases that seemed to fulfill all the histologic requirements.

Throughout 1926 to 1927 all biopsy specimens from cervix cases, in so far as it was possible to do so had been not only described from the histologic standpoint but had been divided into Grades I, II, III, corresponding in a general way with Broder's Grades i, ii, iii, iv.

A certain facility and expertness had therefore been acquired in identifying these different grades which was of great help in studying the 200 cases of the 1922-1923 series.

The general principle followed in grading the tumors was that of the degree of anaplasia present in the cells including also the relative amount of stroma present. Ewing's histologic criteria indicative of anaplasia are cellular overgrowth, atypical qualities of cells, variation in size, shape, and staining qualities of nuclei, infiltration tendencies, loss of polarity, number and atypical quality of mitoses and absence of adult differentiated characteristics.

Just as had previously been recognized by Broders, Martzloff, Schottlaender and Kermauner, et al., it was found that three large groups could be readily established, each fairly distinct from the other.

Group A made up of a small group of cases characterized by cells adult in character, highly differentiated, with a tendency to hornification and pearl formation; this we called the adult type Grade I. At the other extreme there was also a small group, Group C, in which the cells were small and round or spindle shaped, the nucleus markedly hyperchromatic with numerous atypical mitoses. The cells showed absence of squamous character, atypical qualities, complete loss of differentiation, and diffuse infiltrative growth. This was called anaplastic type Grade III.

Between these two extremes there is a larger intermediate group, Group B, showing only partial differentiation and moderate anaplasia. In this group squamous characters are either slight or more often absent. The growth may be atypical but lacks diffuse infiltration, there is a partial loss of polarity. These cells are large and frequently show plexiform arrangement. This we called plexiform type Grade II.

It is, of course, impossible to draw a sharp line of distinction between the three histologic groups. In a small proportion of cases it has been somewhat difficult to decide whether a tumor belonged to the plexiform or anaplastic group. Tumors presenting this structure, however, are distinctly radio sensitive and consequently are classified as anaplastic.

The differentiation between the adult and anaplastic forms has presented no difficulties and the presence or absence of squamous characters has served as a good basis for division between the adult and plexiform types. It should also be realized and borne in mind that we have been very greatly aided in establishing the classification of individual tumors by our knowledge of the probable behavior of the cells in the tumor under consideration to radiation, in addition to a consideration of the histologic criteria referred to. From time to

time, therefore, a tumor has been recognized from its cellular structure as radio sensitive and, although of plexiform type, has been placed in Group iii anaplastic.

One of the important determining elements in influencing us toward anaplasia as a basis for our classification is the fact that we are dealing with end-results based entirely on radiation therapy and for a long time it has been recognized by many writers that the higher the degree of differentiation of the tumor cells, the lower the potential malignancy and the greater the radio resistance of the cells.

Conversely the greater the degree of anaplasia with infiltrative tendencies and loss of differentiation the greater the degree of malignancy and also the degree of radio sensitivity.

Table III shows the relative frequency of the different histologic grades as compared with Martzloff's classification.

TABLE III. SHOWING INCIDENCE OF STRUCTURAL TYPES AS COMPARED WITH MARTZLOFF'S THREE GROUPS

WRITER'S CLASSIFICATION			MARTZLOFF'S CLASSIFICATION		
CELL TYPE	NO. CASES	PER CENT	CELL TYPE	NO. CASES	PER CENT
Adult (i)	35	17	Spinal	30	22
Plexiform (ii)	123	62	Transitional	90	66
Anaplastic (iii)	42	21	Spindle	17	12

As indicated in Table III, the majority of the tumors belong to the intermediate or plexiform group, whereas the smaller groups comprise the adult and anaplastic types of cells. Forty-two out of two hundred cases, or 21 per cent, belong to the highly undifferentiated anaplastic cell type. It is significant that one in five cases of this series is a very cellular, malignant, and anaplastic tumor and consequently highly susceptible to radiation.

A study was made of twenty early and borderline cases which had died despite treatment.

TABLE IV. SHOWING DISTRIBUTION OF STRUCTURAL TYPES AMONG TWENTY FAILURES IN THE CLINICALLY EARLY AND BORDERLINE GROUPS

CELL TYPE	NO. CASES	PERCENTAGE IN 20 EARLY AND BORDERLINE FAILURES	PERCENTAGE IN TOTAL SERIES
Adult	5	25	17
Plexiform	12	60	62
Anaplastic	3	15	21

Table IV fails to show any definite relationship between cell type and result, despite the fact that there was no variation in treatment. This emphasizes the need for recognition of other factors which influence end-results.

A study was made of the cell type in 30 cases of advanced carcinoma of the cervix which had remained well four and five years.

TABLE V. SHOWING THE DISTRIBUTION OF STRUCTURAL TYPE AMONG 30 CASES OF ADVANCED CARCINOMA OF THE CERVIX WELL FOUR AND FIVE YEARS

CELL TYPE	NUMBER OF CASES
Adult	1
Plexiform	15
Anaplastic	14

The result of this study was quite unexpected. It would seem, however, to suggest that the prognosis in the clinically advanced group of cases under adequate radiation therapy is much better, the more cellular and malignant the cell type, as this cell type is decidedly radio sensitive.

It must be borne in mind that these patients all received very thorough irradiation with radium and x-ray.

In order to have a correct basis for comparing the percentage of cures in relation to the clinical stage of the disease and the histologic type under radiation and surgical treatment, respectively, we have grouped our early and borderline cases in each histologic grade together, representing the probably operable cases and the advanced cases in each histologic grade as corresponding to the probably inoperable surgical group and have obtained Table VI.

TABLE VI. SHOWING PERCENTAGE OF CURES IN RELATION TO THE CLINICAL STAGE OF THE DISEASE AND THE HISTOLOGIC TYPE UNDER RADIATION AND SURGICAL TREATMENT, RESPECTIVELY

RADIATION					SURGERY	
CELL TYPE	STAGE OF DISEASE	TOTAL NO. CASES	NO. WELL	PER CENT CURED	PER CENT OF OPERATIVE CURES, J. H. H., MARTZLOFF	PER CENT OF OPERATIVE CURES, MAYO CLINIC, BRODERS
Adult (Grade I)	Early and Borderline	10	5	50	47	53
	Advanced	25	1	4		
Plexiform (Grade II)	Early and Borderline	21	9	43	24	21
	Advanced	102	15	14		
Anaplastic (Grade III)	Early and Borderline	9	6	66	9½	9½
	Advanced	33	14	42		

Examination of Table VI verifies again the importance of early diagnosis as a prognostic factor regardless of cell type.

Table VII shows the relation between prognosis and histologic grade in advanced cases of carcinoma of the cervix treated by radiation.

TABLE VII. SHOWING RELATION BETWEEN PROGNOSIS AND STRUCTURAL TYPE IN ADVANCED CASES OF CARCINOMA OF THE CERVIX TREATED BY RADIATION

CELL TYPE	NO. CASES	CASES WELL	PER CENT CURED
Adult (I)	25	1	4
Plexiform (II)	102	15	14
Anaplastic (III)	33	14	42

From these figures it would seem that the prognosis in advanced cancer of the cervix under radiation therapy is extremely poor in the adult cell type, Grade I, and unexpectedly favorable in the anaplastic type, Grade III.

The conclusion seems justified that in the advanced stage of the disease the prognosis improves with the degree of anaplasia under radiation therapy.

A study of surgical end-results in the treatment of carcinoma of the cervix indicates that the degree of malignancy of the cell type in the individual tumor is a most important controlling factor. The best results are obtained in the highly differentiated adult cell group and the worst in the very cellular infiltrating malignant cell type.

TABLE VIII. PERCENTAGE INCIDENCE OF FIVE-YEAR CURES FOR THE DIFFERENT TYPES OF EPIDERMOID CARCINOMA OF THE CERVIX UTERI

	SPINAL CELL CANCER GRADE II OF BRODERS	TRANSITIONAL CELL CANCER GRADE III OF BRODERS	SPINDLE CELL CANCER GRADE IV OF BRODERS
The Johns Hopkins Hospital (Martzloff) (Surgery)	47%	24%	9½%
The Mayo Clinic (Broders) (Surgery)	53%	21%	9½%
Memorial Hospital (Radiation)	50%	43%	42-66%

### CONCLUSIONS

1. Epidermoid carcinoma of the cervix may be classified histologically into three grades, based primarily upon the degree of anaplasia. These groups correspond closely to three degrees of potential malignancy as well as to three grades of radiosensitivity (low, medium and high).

2. The adult type of carcinoma of the cervix (Grade I) is markedly resistant to radiation; the anaplastic type (Grade III) is highly radio-sensitive, whereas the plexiform type (Grade II) occupies an intermediate position.

3. The factors which determine prognosis in carcinoma of the cervix, as in other diseases, are multiple and not single. The clinical stage of the disease at which treatment is instituted and the radiosensitivity of the tumor are believed to be the most important factors in prognosis when radiation is employed.

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## WHAT CAN WE LEARN FROM A STUDY OF MORTALITIES?

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WE ALL like to report successes, but it is from failures that we learn our shortcomings and the lessons which should be indelibly impressed upon our memories.

A surgical audit is a necessity in every clinic, otherwise, owing to the fact that our successes far out-number our failures, we forget the latter and go complacently along self-satisfied.

At the Long Island College Hospital our organization is such that the major part of the gynecologic and obstetric surgery is done by the junior staff and senior resident. Hence it is imperative that we have a critical review in order that merit may be rewarded and carelessness corrected.

Like general surgery, gynecologic surgery is divided into imperative and elective groups. In the imperative group will fall the tragic ectopics, uterine and other visceral ruptures, torsions and acute suppurative conditions requiring immediate drainage. It is, however, with the elective group that this analysis chiefly has to do.

The woman about to undergo an elective operation for pelvic lesion has a right to be safeguarded from infection, morbidity, and death.

These women are frequently poor surgical risks, for many are overworked, underfed and have struggled along for years with handicapping pelvic lesions which have upset the digestion, drained the tissue fluids, disturbed body metabolism and endocrine balance, lowered the hemic content or impaired the myocardium. Were it not for these coexisting conditions the mortality in gynecology would, with malignancy excluded, be lower than that of a general surgical service, for we are dealing with patients who have an operation on advice, not as an immediate necessity.

In order to safeguard these women, the routine procedure in our department for years has been to require the following minimum pre-operative requisites, before all elective sections, namely:

1. A complete history and general physical examination.
2. A leucocyte count of between seven and ten thousand.
3. A polymorphonuclear percentage of from 65 to 80.
4. A hemoglobin of at least 60 per cent.
5. A sedimentation time of ninety minutes or more.
6. A normal urinalysis, and an adequate kidney function.
7. A temperature of 98.6° F. for at least forty-eight hours before operation.
8. A systolic blood pressure between 110 and 150.

9. A negative Wassermann, and finally, that all elective preoperatives have rest in bed in the hospital for a period of at least forty-eight hours, during which time the intake of fluids, water, milk, etc., must be at least two and one-half quarts *per diem*, while the usual sugar intake of the individual must be at least quadrupled.

Without making any attempt to draw conclusions, except to discover defects, we have analyzed our mortality for the past five years. During this period 4,270 women have been admitted to the gynecologic wards and of these 1,145 were not operated upon, while 3,125 had either pelvic or abdominal operations or both. The total mortality among 4,270 admissions was 138; 43 of these were nonoperative deaths, therefore need not be considered in this analysis. In the 3,125 patients operated upon, there were 95 deaths. Each of the fatal cases has been studied with reference to the preoperative status, the type of operative procedure and the postoperative course. As we have proceeded with the consideration of the deaths in the elective group, it has been illuminating to note that the fatal issue can be attributed to one of the following causes: Some omission or misinterpretation of the history, physical or laboratory findings or (a) important preoperative requisites that make for a good operative risk have many times been disregarded; (b) or the employment of the high Trendelenburg posture, in combination with high blood pressure, has produced cardiac embarrassment, while prolonged Trendelenburg, in patients with low blood pressure, has increased the occurrence of shock; (c) or too much surgery has been done at one sitting; (d) or the time consumed in operating has frequently overreached the maximum of safety; (e) or forty-eight hours of rest in bed, in the hospital, which is so imperative, has been disregarded; (f) or patients have been operated upon who have been the subject of prolonged subacute or chronic infection, with a leucocytosis or a low white cell count, a low polymuclear percentage or a low platelet count, show a poor reaction to any operative procedure, or the introduction of added infection; (g) we have also learned that a low grade temperature of 99.2° F. plus means infection, and operation in such cases should be postponed until the temperature is normal and has remained normal for several days; (h) that operation in most skilled hands, in the presence of an active infection is not only dangerous, but should be limited to simple incision and drainage, and finally that the routine removal of the appendix adds to the morbidity and often to the mortality.

Upon further analysis we find that in the 1,470 laparotomies there were 607 double cases (vaginal and abdominal work done at the same sitting, under one anesthesia). In addition there were 1,529 vaginal operations, not including the 607 above mentioned.

The gross operative mortality for the five years was 2.9 per cent. This we have divided into:



1. *Malignancies*, where the abdomen was opened to confirm a diagnosis and an inoperable condition found. There were 23 of such patients who died from two weeks to ten weeks after operation, during their period of hospitalization.

2. *Emergency Deaths*.—In this group are included 20 patients, 3 tragic ectopics; 3 acute appendices with diffuse peritonitis; 11 cases of pelvic abscess which were drained after periods of prolonged sepsis; 2 gall bladders, and 1 ruptured ovarian cyst.

3. In the *elective group* there were 52 fatalities; 2 of these were vaginal operations, one dying from an intercurrent pneumonia two weeks following operation, and the other from acute suppurative peritonitis, following the use of radium. These will not be considered further in this report.

In the analysis of the preoperative status of the 50 fatal abdominal sections, the following facts are significant: period of preoperative hospitalization, 12 of these had less than twenty-four hours of observation and preoperative preparation; 17 less than forty-eight hours; only 21 had more than forty-eight hours of hospitalization. It is at once apparent that three-fifths of these cases were operated contrary to the regulations laid down in our preoperative routine. It has been our experience that many patients are operated too soon after their admission. A woman who is about to undergo a major operation needs considerable time in the hospital to recuperate from the nervous and physical exhaustion which the preparation in arranging home conditions too often entails. Furthermore, it is not possible in a time less than forty-eight hours to complete the preoperative study of her urine, blood pressure, blood sedimentation time, blood chemistry, Wassermann, and the other clinical and laboratory findings which are so essential to success.

*Blood Studies*.—In these 50 deaths following elective sections, 15 cases had a leucocyte count of above 10,000; 14 a count of less than 7,000 and 21 a count of between 7,000 and 10,000. Here again it is apparent that three-fifths of the cases showed leucocytic evidence of either latent infection or a leucopenia suggestive of low resistance reserve.

In the further study of the blood of these patients, taking 65 to 80 per cent to be the normal limits of polymorphonuclear percentage, we find that 6 cases had a polynuclear count of above 80 per cent; 16 had a count of less than 65 per cent, while 5 had both a white count above 10,000 and a polynuclear count of above 80, and another 5 had both a white count of under 7,000 and a polynuclear count below 65.

This analysis shows that among 50 deaths there were 41 patients who had something abnormal in their preoperative blood or differential count, and should have had further preoperative study before being subjected to operation.

There was only 1 patient in this elective group who was operated with a hemoglobin of under 60 per cent, for it has been our custom to transfuse all patients when the reading is below this standard. During the past three years the blood sedimentation time has been included into the preoperative routine and no patient is subjected to an elective procedure unless it be a simple incision and drainage of an abscess, unless the blood sedimentation time is ninety minutes or more. For, in our experience of over 3,500 readings, we have found that the rapid settling of the red cells is the most sensitive laboratory test to the presence of infection, and even in the absence of leucocytosis and elevation of temperature, a rapid blood sedimentation time indicates subacute or latent chronic infection.

By carefully observing this we have been able to eliminate the lighting up by operation of quiescent infection.

*Blood Pressure* has a signal significance on the prognosis of operative patients. A systolic reading of 110 to 150 may be considered as within the normal range in patients below the age of fifty-five. In this series, 8 had a systolic pressure of less than 110; 11 above 150; only 2 were classed as hypertension, having pressures of 185 and 214 respectively. Ether, gas, and ethylene all increase systolic pressure for a certain period during the administration of the anesthesia; prolonged anesthesia, however, associated with tissue trauma and blood loss, always lowers pressure.

The Trendelenburg posture temporarily increases systolic pressure and adds to cardiac embarrassment or in the presence of hypotension, contributes to surgical shock.

Anesthesia also has its effect upon the renal function. In this analysis there were 6 patients who had a glycosuria; 14 with more than a faint trace of albumin; 1 had casts without albuminuria; 4 had acetouria without glycosuria; 2 had pus in the urine, and 4 were diabetics. From this it is evident that 31 of the 50 had some chemical or microscopic change in the preoperative urine which necessarily increased the operative risk, and probably contributed its part in the final tragedy. Furthermore, the kidney function as demonstrated by the phenolsulphonephthalein test and the concentration estimation, are important preoperative essentials. Study of these records shows that little reliability can be placed upon the former, unless the drug is administered intravenously and, notwithstanding the fact that all but four had an estimated phthalein of over 40 per cent, the postoperative records indicate kidney inefficiency.

Low grade temperature prior to operation has a greater significance than has generally been attributed to it. Twenty-eight of our patients had a temperature of 99° or more during the twenty-four hours prior to operation; then, in the light of this study, all of these 28 should

have had their operations postponed, for operative trauma excites a reaction in these quiescent low grade infections.

In determining the type of operation for a particular case, one is frequently confronted with a multiplicity of lesions. For example, in prolapse we commonly have to deal with a cystocele, enterocele, infra-vaginal hypertrophy of a lacerated cervix, subinvolution and backward displacement of the enlarged uterus. The correction and cure of this pathology requires a series of plastics, all of which are time-consuming, and not infrequently upon opening the abdomen to complete the operation by shortening the round and uterosacral ligaments, the surgeon is confronted with the problem of what to do with the appendix. Many times there has been a history of a chronic or sub-acute appendicular involvement, or on inspection the appendix is kinked, held down by adhesions, or contains concretions, all of which may be accepted indications for its removal, yet experience teaches us that the prognosis is definitely influenced by this routine procedure.

To illustrate this fact we have studied the charts of 100 patients on whom we did a hysterectomy for fibromyomas of the uterus without coexisting infection; in 50 of these the appendix was removed, while in the second group of 50, the appendix was not disturbed.

<i>Morbidity</i>	WITH APPENDECTOMY	WITHOUT APPENDECTOMY
Average number days with temp. above 100.4°	3.0	2.3
Wound infections	5.0	0.0
Stitch abscesses	3.0	0.0
Pelvic abscess	1.0	0.0
Local peritonitis	1.0	0.0

In the fatalities among the 50 elective sections, the appendix was removed 17 times, 15 of these as routine, or by request. In the laparotomies which were done to supplement plastic procedures for birth injuries and displacements, 6 appendices were removed; in connection with hysterectomy 8 times and in the course of other abdominal operations 3 times. Therefore, in 17 of our fatal sections, the appendix was removed. Hence we must admit that, based on these figures, multiplicity of operations and incidental appendectomy contributed largely to the unsatisfactory results recorded in this series.

Another factor which makes for the success or failure in an operation is the time consumed in operating. The average operating time in this group of 50 was seventy-six minutes; less than sixty minutes were consumed in 18 and more than sixty minutes in 32. It is therefore evident that three-fifths of these patients had a longer period of anesthesia than can be considered as the safe maximum.

The indications for operation according to postoperative diagnosis were as follows:

Fibroids, uncomplicated	9
Fibroids and infection	5
Adenomyoma	2
Adenomyoma and infection	1
Fibrosis uteri and endocervicitis	1
Perimetritis, subacute salpingitis	3
Acute salpingitis	2
Tuberculous salpingitis	4
Postpartum infection (multiple thrombophlebitis)	1
Bilateral dermoid and infection	1
Inflammatory tumor of sigmoid	1
Lacerations and retroversion	2
Lacerations and small fibroid	1
Lacerations and chronic appendicitis	1
Lacerations, endocervicitis and prolapse	2
Lacerations and cholelithiasis	1
Nontragic ectopic	2
Nontragic ectopic and hydrosalpinx	1
Serous cyst, adenoma, bilateral	1
Subacute salpingitis, pyosalpinx	1
Acute salpingitis, ovarian cyst	1
Mitral stenosis (sterilization)	1
Fibroid and peritonitis	1
Subacute peritonitis	1
Subacute cholecystitis and subacute appendicitis	1
Cholangitis	1
Subacute cholecystitis	1

Study of the foregoing list of pathologic indications throws little light upon the end-results, except that among these fatalities, birth injuries or their sequelae were the predominating lesion in seven instances, yet other operations requiring the invasion of the peritoneal cavity were performed. Combination operations done on the pelvic structures and upon the viscera of the upper abdomen at the same time cannot be accepted as sound surgical judgment, and are in violation of accepted surgical principles; we have had 2 deaths which may be attributed to this cause.

Operation in the acute or subacute stage of adnexal infection is still a debatable question among many operators; however, in this clinic we seldom operate while the lesion is "hot," except to incise and drain a pelvic or appendicular abscess; yet, in this analysis we find 6 deaths which can be directly attributed to bad judgment in not accepting the evidence of a rapid blood sedimentation time and other blood findings indicative of pus.

Nature establishes protective barriers in every infection; manipulation and dissection break these down and spread the infection: "pus is pus" and should be drained and not spread. Too often the operator opens the abdomen on a faulty diagnosis and finds purulent foci and has not the courage or the judgment to back out and drain, but attempts extirpation in friable tissues, disseminating the infection.

We next come to the consideration of the question, from what did these patients die? The cause of death as recorded on the hospital

record is too often incorrectly stated as myocardial failure. Only 8 cases of 29 so classified can be accepted as true circulatory failures. For a detailed study of the postoperative course points to infection and peritonitis. Twenty-one have been reclassified at Staff Conference or at autopsy as fulminating infection or peritonitis.

It is further interesting to note that of this number only one of the 8 had definite cardiac symptoms prior to her operation, yet among more than 300 patients operated for abdominal lesions who recovered, there were many who had murmurs or symptoms of cardiac distress.

We have come to the conclusion that a preoperative case which has a definite history of a cardiac load has a better chance for an operative recovery than many of these women who are admitted and go to operation with no signs of heart lesion, for in the former greater care is taken in their preparation, their anesthesia is more carefully selected and less surgery is done, or, if an extensive procedure is necessary, it is done at several sittings. The other seven cases included two pulmonary emboli, one coronary thrombosis and four cardiac failures. In three of the latter, high blood pressure in conjunction with the Trendelenberg posture and prolonged anesthesia resulted in death within eighteen hours after operation; all three were difficult to anesthetize, being of the obese, short-necked type, their ages ranging from forty to sixty-two years. The fourth case was an opium addict, dying of postoperative exhaustion.

Surgical accidents and complications are often unavoidable and certainly are not preventable. Table I is illustrative of this group.

TABLE I. POSTOPERATIVE COMPLICATIONS—SURGICAL ACCIDENTS

DIAGNOSIS	OPERATION	CAUSE OF DEATH	
1. Lacerations, Retroversion	Plastics, Laparotomy	Lobar Pneumonia	6 da.
2. Fibroids, Salpingitis	Hysterectomy Plus	Bronchopneumonia	7 da.
3. Ectopic	Colpotomy, Salpingitis	Lobar Pneumonia	4 da.
4. Lacerations, Fibroid	Plastics, Radium, Lap.	Parotitis-Pneumonia	21 da.
5. Adenomyoma	Hysterectomy	Urinary Suppuration	2 da.
6. Fibroids	Hysterectomy Plus	Wound Rupture	70 da.
7. Subacute Appendicitis	Appendectomy, Susp.	Wound Rupture	20 da.
8. Cholangitis	Cholecystotomy	Wound Hemorrhage	28 da.

#### Comment

1. 7,150—Poly. 61—Temp. 99.2°—Operation 100 Min.—Interval Appendectomy.
2. 6,600—Poly. 78—Operation 70 Min.—Appendectomy.
3. 10,600—Poly. 76—2 Per Cent Sugar—Operation 55 Min.—Colpotomy and Curettage—Wassermann 4+.
4. 11,200—Poly. 65—B. P. 112/76—Operation 75 Min.—Appendectomy.
5. B.P. 18/100 F. T.—Albumin—Ureter Cut.
6. 11,800—Poly. 70—Temp. 99°—Interval Appendectomy—Sutures Removed Eighth Day—Previous Cardiac.
7. 7,800—Poly. 64—Should Not Have Been Operated (Surgeon) Wound Opened Seventh Day.
8. 6,400—Poly. 64—Intense Jaundice 2½ Months—Wound Hemorrhage—Peritonitis.

TABLE II. CIRCULATORY GROUP

DIAGNOSIS	OPERATION	TIME	W.B.C.	PMN.	PRE-OP. T.	URINE
1. Cyst, Salpingitis	Salp. Oophorectomy	35M.	15,600	86	100.6°	Alb.
2. Ectopic, Hydrosalpinx	Perin., B. S. & O. Susp.	60M.	9,900	72	99.0°	Neg.
3. Adenomyoma, Salp. Oophoritis	Hyst., B. S. & O. App.	70M.	7,400	74	Norm.	Neg.
4. Ectopic	Curettage, S. O.	70M.	4,300	60	99.0°	Neg.

*Comment*

1. Ovarian Cyst Ruptured Twelve Hours Before, Acute Salpingitis—Cardiac?
2. Rectal Injury in Doing Perineorrhaphy—Septicemia.
3. Following Day Chills. Profound Toxemia—Cardiac?
4. Cardiac Death?

TABLE III. CIRCULATORY GROUP

DIAGNOSIS	OPERATION	TIME	W.B.C.	PMN.	B. P.	PRE-OP. T.	DIED HR.
1. Perimetritis, Salp. Oophoritis	Plast., Hyst., B. S. O.	170M.	8,200	56	152/90	N.	39
2. T.B.C. Salpingitis	Hyst., B. S. O.	100M.	9,400	57	110/70	N.	43
3. Sigmoid Uleer, S. Oophoritis	Hyst., B. S. O., Colost.	105M.	11,000	77	115/65	N.	66
4. Subacute Cholecystitis	Cholecystectomy	55M.	6,400	57	90/60	99.2	55

*Comment*

1. Treated Diabetic—Double Operation—Delayed Shock.
2. Profound Shock—Slow Weak Pulse—Cardiac Collapse.
3. Albumin in the Urine—Temperature 104°—In 13 Hr. Cardionephritic.
4. Jaundice 2 Mo.—Delayed Shock—Cardiac Failure.

TABLE IV. CIRCULATORY GROUP

DIAGNOSIS	OP. TIME	B. P.	W.B.C.	P.M.N.	PRE-OP. TIME	URINE
1. Fibroid, Necrosis, Hydrosalpinx	100 M.	120/74	6,800	69	99.4°	Alb.
2. Salp. Oophoritis, Perimetritis	85 M.	86/70	8,800	71	Norm.	Neg.
3. Fibroid Uterus	75 M.	97/58	5,900	68	99.2°	Neg.
4. Fibrosis Uterus	105 M.	160/102	8,200	73	Norm.	Neg.

*Comment*

- 1-2-3. Supracervical Hysterectomy, Bilateral Salpingo-oophorectomy.
4. Panhysterectomy.
- 1-2. Severe Shock—3 None—4 Mild—600 c.c. Blood Loss.

TABLE V. PERITONITIS

DIAGNOSIS	OPERATION	TIME	B.P.	W.B.C.	PMN.	DIED
1. Fibroids	Hysterectomy	90 M.	162/100	12,200	85	3 Da.
2. Fibroids, Infection	Panhysterectomy	115 M.	164/ 84	9,800	68	5 Da.
3. Serous Cyst, Bilat.	Bilat. S.O., Susp., App.	60 M.	112/ 72	6,600	68	4 Da.
4. Fibroid	Mymocetomy	60 M.	114/ 70	9,000	50	7 Da.
5. Fibroid	Hysterectomy	160 M.	110/ 70	16,900	64	5 Da.

*Comment*

2. Temp. 99.2° Before Operation—Injury to Bladder.
4. Albumin in Urine—Fell Out of Bed 5th Day.
5. Albumin in Urine—Shock—Considerable Blood Lost at Operation.

TABLE VI. PARALYTIC ILEUS—LOW GRADE PERITONITIS

DIAGNOSIS	OPERATION	TIME	B.P.	W.B.C.	PMN.	PRE-OP. T.	URINE	DIED DAY
1. Adenomyoma	Hyst., Bilat. S.O.	85	135/65	6,300	80	99.0°	Neg.	7th
2. Fibroid Cyst	Hyst., B.S.O., App.	80	116/66	13,500	65	99.8°	Neg.	4th
3. Lac., Retroversion	Plast., Susp., App.	75	100/66	9,400	80	99.0°	Sug.	6th
4. Cholecystitis	Cholecystect., App.	60	105/70	10,200	62	99.4°	Trace alb.	7th

*Comment*

1. Highest Temperature P.O. 100.8°.
  2. Pseudomucinous Cyst—Gastric Dilatation—Progressive Rise in Temp. to 101.8°.
  3. Possible Intestinal Obstruction.
  4. Extreme Exhaustion, Slow Pulse.
- All Cases—Low Temperature

Operation in the most skilled hands in the presence of an active infection is always dangerous and especially so when preceded by a prolonged period of septic absorption. Table VII is self-explanatory.

TABLE VII. PROLONGED SEPSIS—MAJOR OPERATION—SHOCK

DIAGNOSIS	OPERATION	TIME	W.B.C.	PMN.	PRE-OP. TEMP.	DIED
1. Tbc. Salpingitis	Hyst. Bilat. S. & O.	70 M.	16,800	80	99.0°	41 Hr.
2. Tbc. Salpingitis	Hyst. Bilat. S. & O.	60 M.	11,250	80	100.4°	41 Hr.
3. Ac. Purulent Salping.	Panhyst. Bi. S. & O.	105 M.	10,000	85	99.0°	87 Hr.
4. Postpart. Inf.	Part. Hyst., S. & O.	60 M.	15,200	88	103.4°	48 Hr.
5. Fib. Rad. Peritonitis	Cecostomy	70 M.	10,800	87	102.6°	14 Hr.

*Comment*

1. Posterior Colpotomy 25 Days Before.
  2. Postoperative Sinus 6 Months.
- In all cases frank pus was found.

A detailed study of the Tables of the 16 patients who died from what we class as acute fulminating infection reveals the fact that in the preoperative record there is evidence of latent infection or potential infection with poor resistance shown by a leucocytosis or elevation of temperature or a leucopenia, or a low polynuclear count, and yet the significance of these findings was overlooked. Furthermore, microscopical examination of the pathologic specimen removed from 12 of these women shows the cell changes of subacute inflammation or of recent activity in an old inflammatory process.

In contrast with this group there are 5 fatalities in which the symptoms and clinical picture is that of a definite spreading peritonitis.

In the last group we find 8 deaths due to paralytic ileus and a low grade peritonitis. All of these had some suggestive danger signal in their preoperative record, yet it was passed over without comment.

Our experience in pelvic surgery has not been that late postoperative distention and vomiting is due to an actual obstruction or band constriction, but, rather, that it takes the form of partial obstruction; many times there is passage of gas by the rectum and even bowel

movement, but the vomiting continues and the gas quickly reaccumulates after an enema or lavage.

Reopening on autopsy has invariably revealed some loop of intestine slightly adherent to a point in the operative field or to the abdominal wound, slightly kinking the bowel lumen but not obstructing it. The pulse and temperature are not much elevated, yet regurgitant vomiting, distention, and gas pains persist. The vomiting quickly recurs after lavage.

High enterostomy under local anesthesia without disturbing the exudative process, near the operative field, will save many but it must be done early.

A review such as presented is a sad commentary on our surgical judgment and our surgical care, for even a casual study of the facts show that:

1. Not sufficient attention is given to the suggestive findings developed in our preoperative study.
2. That surgical judgment can only be developed by pathologic study of the living.
3. That the patient pays the cost of training men, for speed and technic are the products of training, and finally that such reviews are illuminating in that they reveal our errors.

20 LIVINGSTON STREET.



## Books Received

NURSES, PATIENTS AND POCKETBOOKS. Report of a study of the economics of nursing, conducted by the committee on the grading of nursing schools. May Burgess, director, New York City, 1928.

PRAKTIISCHE DIFFERENTIAL DIAGNOSTIK. Band V, Frauenheilkunde. Bearbeitet von Professor Dr. A. Seitz, Universitaet Giessen. Verlag von Theodor Steinkopff, Dresden, 1928.

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MATERIAL AND METHODS OF THE GYNAECOLOGICAL AND OBSTETRICAL DEPARTMENT IN THE UNIVERSITY OF LIVERPOOL. By Blair Bell, professor of gynaecology and obstetrics, etc. Manchester, Sherratt & Hughes, 1928.

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TROPICAL MIDWIFERY. By V. B. Green-Armytage, M.D. in Calcutta. Thacker, Spink & Co., Calcutta and Simla, 1928

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## Original Communications

### THE TEACHING OF OBSTETRICS\*

BY PALMER FINDLEY, M.D., F.A.C.S., OMAHA, NEBRASKA

AT THE meeting of this Association held last year it was resolved to submit to the Council of Medical Education of the American Medical Association and to the American Association of Medical Colleges, a plea for equal recognition of General Surgery and Obstetrics in the curricula of our medical schools.

The pathway of obstetrics, long and perilous as it has been, recalls the epic of the Odyssey. Let us hope that it will end as happily for obstetrics as it did for Ulysses who succeeded in freeing his own house and in recovering his kingdom.

From the time of the introduction of the obstetric forceps the practice of midwifery by the medical profession was fairly easy sailing, though it is of interest to note that as late as the eighteenth century there was much prejudice against the obstetrician. Gaillard Thomas writes of the feeling of the community when Dr. James Lloyd, a pupil of Smellie and Hunter, settled in Boston in 1753. He was the first of American obstetricians and was soon followed by William Shippen of Philadelphia. With these two men began the struggle to place obstetrics on a parity with medicine and surgery in America. The success of their efforts is attested to by the fact that in 1762 Dr. Shippen delivered the first course of lectures on obstetrics in Philadelphia, and four years later Dr. J. V. B. Tennant was appointed to the chair of obstetrics in New York City. From this time to the present, obstetrics has held a creditable though not too eminent position in medical education and practice.

\*Address of President, American Association of Obstetricians, Gynecologists and Abdominal Surgeons, Toronto, September 11, 1928. The transactions of this meeting will be published in a special issue of the Journal at a later date.

In the sixteenth century Dr. Veitis of Hamburg, Germany, was condemned to the flames for attending a woman in labor; while in our own land, as late as 1754, Dr. James Lloyd of Boston and Dr. William Shippen of Philadelphia were roundly denounced for their immorality and licentiousness in a similar performance of their professional duties. But the calumny heaped upon these two men was as nothing compared to that which was meted out to Doctor James P. White as an aftermath of an obstetric demonstration in a clinic held in the Medical Department of the University of Buffalo, New York, in 1850. White was charged with the commission of acts of outrage against the rights of the community, against decency and propriety. He was libeled by the press and bitterly attacked by members of his own profession. But happily he was ably supported by members of his faculty and by such eminent men of the day as Chandler R. Gilman, Professor of Obstetrics in the College of Physicians and Surgeons of New York, Charles B. Coventry of the University of Buffalo, and Austin Flint of New York. These and many other medical men of eminence testified in the suit for libel of "The People versus Horatio N. Loomis." The vindication of Dr. White resulted in the establishment of the first obstetric teaching clinic in America and the honors go to the University of Buffalo; although it is said that in the United States the first systematic clinical instruction in obstetrics was given in Baltimore by Rohes in 1874.

The first course of lectures on midwifery given to men was probably the work of Gregorie, the younger, in 1733. Three years later Smellie began his private lectures in London to be soon followed by Strassburg, Berlin, and Gothenburg. Dr. Young of Edinburgh is authority for the statement that prior to 1751 midwifery was taught only by lectures in Paris, London, and Edinburgh and from the middle of the eighteenth century courses of lectures and lying-in institutions were established in the chief cities of Europe. Fairbairn tells us that "England lagged so far behind Scotland and the Continent that it could not boast a University Professorship of Midwifery, and, what is still more startling, till the Medical Act of 1886, it was unnecessary for the medical student to be qualified in midwifery before being registered as a practitioner."

During the course of the second half of the eighteenth century obstetrics became a part of the clinical instruction in medical schools. In this way physicians gradually took the practice of obstetrics out of the hands of the surgeons. Thus obstetrics gradually became separated from surgery. However, clinical instruction in obstetrics was still a part of surgical clinics until late in the nineteenth century in certain cities in Germany. Germany was trailing behind France, Holland, England, and Scotland when John George Roederer, at the age of twenty-five, was called to Göttingen in the middle of the

eighteenth century. In his inaugural address he claimed for obstetrics equal recognition with medicine and surgery. He founded an obstetric pavillion at Göttingen and placed German obstetrics on an equal footing with that of other countries.

It may be said that the emancipation of obstetrics from surgery was "the result of the introduction of the obstetric forceps and of the writings and labors of independent teachers of obstetrics whose endeavors were directed to the making of labors less bloody and less dangerous."

Our English colleagues (notably Prof. W. R. Dakin of Saint George's Hospital, London) are wont to speak of midwifery as the Cinderella of medicine. When we reflect upon the struggle which obstetrics has endured in securing recognition alongside of medicine and surgery, we recall the emotions of our childhood days when we believed in fairies; when we saw, in our fancies, poor little Cinderella sitting in the ashes. And how we resented the two elder, adopted sisters when they took away her toys and gave her all the hard work to do. And how she yearned for fine dresses that she, too, might go to the ball! But eventually, you will recall that Cinderella did go to the ball through the gracious metamorphosis of pumpkin, mouse-trap, mice and lizards and the kindly intervention of the fairy god-mother. To be sure, Cinderella was rebuked by her elder sisters and for a time she again found herself sobbing among the cinders. And then how delighted we were when the messenger came and drove her in a fine coach to the palace where the Prince awaited her and made her his bride. We will not pursue the story further because it does not end as we would have it for the two elder sisters. We would not depose medicine and surgery from the high positions they have attained, we only ask that obstetrics may share with them, share and share alike.

From the standpoint of emergencies requiring masterly and timely exercise of one's faculties, obstetrics may be fairly said to assume priority over all other departments of medical practice. Confronted with such emergencies as obstetrics presents, the practitioner has no time for sharpening his wits or for awaiting the assistance of a consultant. He is alone with his problem and he must fight alone. Chipman says: "I have never heard it denied that in this general equipment, a large place ought in all conscience be given to obstetrics. And yet, speaking generally of our medical schools, *this very training in obstetrics is the weakest page in the curriculum*. Our academic vision has been blinded by the brilliancy of achievements in surgery. The glamour of the operating amphitheater has lured the student and captured his imagination." And it is no small wonder that he has little stomach for the watchful waiting of the lying-in room. I submit that it is a thousand pities that so much time is utterly wasted on the

benches of amphitheaters, watching with unseeing eyes the gyrations of the scalpel. How much more would it profit the student to employ this time in observing the phenomenon of birth under the direction of a master obstetrician. The need is for more practical training and clinical instruction in the art of midwifery, and this need can only be supplied in hospitals and dispensaries.

I think it is generally conceded that the out-patient service is a poor substitute for the dispensary and the hospital and in this respect most of our teaching institutions are woefully lacking, for the simple reason that they do not have adequate hospital accommodations. To send students into homes where filth abounds, unattended by an experienced clinician and with no more than a smattering of theory to sustain him, is a ghastly business and cannot be justified by lack of adequate hospital facilities. There is no more virtue in teaching obstetrics to a group of observers than in teaching operative surgery from the benches and we all know from experience what that means. There must be direct contact and individual responsibilities if the lessons are to be driven home, and above all it is essential that the student live for a time in an obstetric atmosphere. G. W. Theobald of London, England, says: "When I reflect on the care, skill, teamwork and money expended in the operating theaters of our land in patching up broken men and women, and then reflect on the inadequate training which allows men to kill and cripple women in their prime, women who are performing the act for which they were created; when I consider the sum total of misery which is daily mounting through bad obstetrics; when I realize that the country of Simpson, Lister, Smellie, and Hunter is no longer mentioned in the literature of obstetrics, I feel constrained to make a plea for radical changes in the attitude toward midwifery, and to hope that these changes will be made by the profession before unnecessary and ill-directed control is exerted by the state."

And from another source in England we read from the pen of Comyns Berkeley that: "The present maternal and fetal mortality and morbidity associated with pregnancy and childbirth will not be appreciably improved until the midwifery service of the country is more complete, and medical students are taught midwifery more efficiently. That in the efficient training and teaching of medical students in midwifery, the community, as opposed to the individual, is more directly and personally concerned than in that of any other subject in the medical curriculum. Not only is this so on the score of health, but also for economic reasons. The only place in which the practice and art of midwifery can be properly taught is in a maternity hospital or in the maternity wards of a general hospital. And that there are not sufficient beds available for this purpose." The responsibility for this discrepancy lies, says Berkeley, at the door

of the internists and general surgeons who have never realized until quite recently, the importance of midwifery to the nation, with the result that insufficient beds were allotted to the department of midwifery; too little time was provided for instruction and the facilities for teaching, laboratory and research work were inadequate. "Thus it came to pass that the ideas of medical students with respect to the importance of midwifery to the community were the result of a vicious circle." Indeed, it was not until 1869 that in England midwifery was included as a compulsory subject in the curriculum of medical students. And yet no less an authority than Dr. Fairbairn says that "in the efficient practice of midwifery is to be found the greatest example of preventive medicine in the medical curriculum."

In the report of the Committee on Maternal Welfare (1925) the statement is made that the services of the general practitioner are proportioned about as follows: Internal medicine, 50 per cent; obstetrics, 35 per cent; minor surgery, fractures, life insurance, etc., 15 per cent. A study of the curricula of our medical schools showed that in actual teaching hours the ratio of obstetrics to general surgery, exclusive of surgical specialties, was as 4 to 18. Clearly, then, there is cause for a revamping of the curriculum if the needs of the general practitioner are to be adequately provided.

Dean Emerson of the College of Medicine of the University of Indiana says: "It is the business of medical schools to prepare students for the first two years of the practice of medicine." It is presumed that with such an equipment the graduate will acquire added knowledge and skill to the end that he may assume larger responsibilities. Assuming that the premises of Dean Emerson are reasonable what, then, we ask, are likely to be the demands of the first two years of practice in relation to general surgery and obstetrics? A knowledge of surgical diagnosis and the ability to do minor surgery and to administer first aid in major surgical lesions would seem to be all that could reasonably be demanded of a young practitioner of medicine. But in the practice of obstetrics, there is no problem, however grave, that may not require the services of the neophyte in medicine. Placenta previa, eclampsia, ectopic pregnancy, ruptured uterus, contracted pelvis; these and many other obstetric problems may present themselves in the earliest years of practice and under conditions that admit of no opportunity to shift responsibilities. More than this it will be as incumbent upon the young practitioner, as upon the older and more experienced, to recognize the danger signals and to exercise the needed skill to avoid disaster.

And so I assume that it is indeed a reasonable request that the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons make to those who are empowered to regulate the curriculum in our medical schools, that the teaching of obstetrics be given

more equitable recognition, to the end that our graduates of medicine may be reasonably prepared to meet the demands of the general practice of medicine.

More than four hundred letters of inquiry were sent to the deans of medical schools all over the world, exclusive of the United States, and to a group of obstetricians representing the entire medical world. The response was most generous and courteous. I have appended an analysis of the replies and will here quote from some of them:

Professor R. W. Johnstone of the University of Edinburgh writes: "In my valedictory address to the Edinburgh Obstetrical Society last month I referred to this same subject and my complaint was exactly the same as yours; namely, that the time allotted to obstetrics in our present curriculum is relatively and absolutely too little." Johnstone finds no fault with the systematic teaching of obstetrics, but says: "When one considers the vital importance of practical obstetrics it is absurd that three months should be allotted to this subject and a similar period of time allotted to such other subjects as tuberculosis, diseases of the ear, nose and throat and even to diseases of the skin."

Mr. Herbert Spencer of London, England, writes that "An effort is being made in England to devote the same amount of time to obstetrics and gynecology as to medicine and general surgery." Beckwith Whitehouse of Birmingham, England, confirms this statement and says that in England the "importance of the subject is being recognized more and more each year."

Dr. Fletcher Shaw of Manchester University quotes an old teacher of his, Sir William Sinclair, "Students are taught surgery which they will not practice and later practice midwifery which they were not taught."

We learn from Professor N. S. Wales of the University of Sydney, Australia, that in the medical schools of Australia obstetrics does not share equally with general surgery and that in his opinion "it is not necessary, as a great deal of obstetric work is founded on surgical science and technic which are learned in surgical lectures and demonstrations." Again from Australia we hear from Professor Ch. M. Syd of the University of Adelaide that "The teaching of obstetrics in Australia has, until quite recently, been much neglected." Dr. H. Howitt writes: "In my active days the medical schools of Canada gave obstetrics (exclusive of gynecology) an equal number of teaching hours to that of general surgery. So, too, was it the case in England in my student days—not so today."

Professor Kedarnath Das of Calcutta, India, tells us that the majority of cases are attended by midwives and the practitioner is usually sent for in difficult cases. He says, "I feel very strongly that students of midwifery are denied their legitimate privilege of witnessing their professors of obstetrics performing obstetric operations, while they obtain the fullest advantage of observing surgical operations performed by their professors of surgery."

From Cardiff, Professor E. J. MacLean writes that in common with other teachers of obstetrics in Great Britain he is having considerable difficulty in securing what one might regard as even a moderate allocation of the curriculum for the teaching of obstetrics whether theoretical or practical. "I am convinced," says he, "that unless and until this wrong is righted there is but little hope of substantially reducing the puerperal mortality and morbidity rates which are truly regarded as a subject of world-wide concern."

Professor A. F. Hamilton of Byculla, Bombay, India, writes of the embarrassment of teaching obstetrics in India because of the caste and purdah systems in

vogue, women being reluctant to be attended by male doctors. Nevertheless, 1200 to 1400 cases are delivered annually and a considerable proportion of these are abnormal cases. Each student is required to conduct deliveries in 20 cases and is permitted to witness many scores of cases. "Our trouble here," says Professor Hamilton, "is to persuade pregnant women of the value of antenatal observation. They are so ignorant and apathetic and hence we still have far too many tragedies."

Dr. G. W. Theobald, Professor of Obstetrics and Gynecology at the Chulalongkorn University, Bangkok, Siam, has the following to say: "I very much regret that obstetrics does not share equally with general surgery in teaching hours. Basing its figures on those suggested by the Association of American Medical Colleges, the faculty have reduced the number of hours devoted to obstetrics, and would have liked to reduce them still further. At present the hours are divided as follows: pathology 647; medicine 1108; surgery 757; obstetrics and gynecology 402.

"It is rather interesting to reflect that in this country the greatest single cause of death is almost certainly puerperal sepsis. There are many more deaths as the result of childbirth than there are from cholera, typhoid, typhus, and plague put together. The maternal and infant deaths account for over one-third (probably nearly a half), of the total deaths in the country in any one year. Yet, in order to model itself as closely as possible on the American system, obstetrics, the most important subject in this country, is relegated to the least important place in the curriculum, and pathology is allowed half as many hours again, although not 10 per cent of the students will ever own a microscope.

"Sitting in far away Bangkok, by the side of the Klongs, in the sound of the Cremation Rockets, I have the feeling that logic and argument will offer but little appeal to our profession, and that the women will go on being butchered, until such time as a relatively trivial incident will somehow startle the public and cause the necessary changes to be made in a manner which may be unfortunate."

Professor de Ott of Leningrad sends greetings to our Association and tells us that in his school obstetrics shares equally with surgery in teaching hours. From 500 to 600 students annually receive instruction in his gynecologic institute.

J. Preston Maxwell, from the Peking Union Medical School, writes that "In no place in China does obstetrics share with general surgery the same number of teaching hours, and in most of the schools the obstetric teaching is in an infant condition. It must be remembered that obstetrics has had to make its way in this country against considerable odds due to prejudice and custom. It is now showing healthy signs of growth and all over the land quite apart from the medical schools, the training of midwives is in the air, and this is in the hands of the medical profession."

From Professor Robert Dobbey of Cairo we learn that "In the medical schools of Egypt obstetrics does not share equally with general surgery in teaching hours, but obstetrics and gynecology together do." He says, "We live under peculiar difficulties in Egypt, having the harem principles to contend with. It is impossible to institute an external maternity charity for male medical students. The only practice that our students get in obstetrics is in the hospital where, with great difficulty, we manage to persuade certain women to come for their confinements. This, however, has only resulted from twenty years of unremitting labor on the part of Dr. Dobbin. The net result, however, of the unfortunate prejudice against male doctors in the harem, is that we get a large number of cases of ruptured uteri and similar complications. There was no obstetric teaching in Egypt thirty years ago, when this school was revived; nor does there appear to have been any obstetric teaching since the beginning of the Moslem era, A.D. 700. As far as we can gather from a study of the mummies and of the medical papyri of dynastic



Egypt (dating to 3000 B.C.) the practice of obstetrics was deplorable. We have some mummies, even of royal families, in which death had evidently taken place in childbirth and no attempt made by cesarean section or other means to relieve these cases of obstructed labor. The harem principle, however, shows signs at last of giving way before the progress of Egypt in other directions, since the King showed the example of having English nurses and doctors for the Queen's babies."

From Buenos Aires Dr. Frank R. Pasman is authority for the statement that obstetrics shares equally with general surgery in teaching hours. The buildings and equipment of the Maternity Institute at Buenos Aires are unexcelled.

Professor Alberto Ramos of Buenos Aires is an ardent champion of the combination of obstetrics and gynecology in teaching institutions and in practice. The obstetricians of South America are waging the age-long conflict with the midwife and the general surgeon and it is gratifying to note that astonishing progress has been made in the development of modern maternities and well-organized departments of obstetrics and gynecology. Professor Ramos says, however, that their students are not sufficiently instructed in obstetrics; that the knowledge of the student at the time of graduation is no more than mediocre and their technical capacity almost nil. He is far from being capable and self-reliant for want of practical clinical experience. Indeed he is not sufficiently trained to appreciate his limitations. No less than three months of maternity service would reasonably equip the student for the responsibilities of a general practice says Dr. Ramos. In the Argentine the doctor is rapidly replacing the midwife in practice and is encouraged to refer his cases of dystocia to maternity clinics, for the dual purpose of better service to his patient and added instruction for himself.

In Sweden clinical obstetrics was introduced by Johan von Hoorn in 1662, but was not required as part of the curriculum until a century later. Essen Moller tells us that "Instruction did not attain its full efficiency until the year 1851." The students in the University of Lund devote four months to clinical obstetrics, living and breathing the atmosphere of the clinic. Each student will have personally conducted an average number of 38 to 40 labors, 1 to 2 forceps, and 1 to 2 abortions. Some will have performed versions, manual delivery of the placenta and like maneuvers. "It is significant," says Essen Moller, "that, though there have been many changes in the curriculum of the university, no alteration has been made in the time-honored arrangement of the obstetric and gynecologic teaching." This he ascribes to the practical work under the teachers' control and the fact that the students develop self-reliance and a sense of responsibility.

Stockholm presents one of the most comprehensive systems for the teaching of obstetrics. Nowhere in the world does it appear that the student is given greater opportunities for practical instruction. Here the first obstetric clinic was established in Sweden by Johan von Hoorn in 1662.

Professor Kr. Brandt of Oslo, Norway, reports double the time allotted to general surgery as to obstetrics and gynecology combined. He opines that the combined chairs of obstetrics and gynecology is the only right policy and adds that this policy is pursued throughout Finland, Germany, and Austria and is fast becoming so in France and Great Britain.

Professor S. A. Gammeltoft of Copenhagen expresses the opinion that "our teaching (Denmark) regarding the theoretical side is full up to date, but the practical side ought to be better; one month's practical work is not enough."

Professor D'Rossier of Lausanne, Switzerland, writes that obstetrics has almost the same number of hours as has surgery and internal medicine.

Professor P. C. T. Van der Hoeven of Leiden, Holland, is now devoting double the time to the teaching of obstetrics as was given forty years ago, but general surgery still holds nearly double the number of teaching hours.

Professor Cesare Decio of the University of Sienna, Italy, writes that "In the medical schools of Italy generally the teaching of obstetrics is given about the same time as is surgery, the proportion being 5 to 6. The teaching of obstetrics began in this institution in 1762 with Jacopo Bartolomei as head of the Department of Obstetrics, Anatomy and Surgery and the surgeon remained in control of obstetrics until 1859."

Professor Henri Vignes of Paris writes: "The French system of teaching is not bad in spite of all criticism to the contrary. The privileges we grant our students are excellent. Our great surgeons and doctors are neither inferior nor superior to those of foreign lands. Our courses are long and numerous. For example one begins his studies at eighteen years of age, is an externe at twenty, an interne at twenty-three, a doctor at twenty-seven, chief of staff at twenty-nine to thirty, hospital doctor without service at thirty-three. He completes his training at thirty-five, may obtain a service by forty-one and may, but may not, become a professor at fifty to fifty-five, 'long after the flame of youth is extinct.' There are 5000 students in Paris and it becomes necessary to give many of the students their clinical training outside the University clinic. This need is supplied by eleven or twelve hospitals in Paris, where lectures and demonstrations are given every morning throughout the academic year of nine months. Here surgery is allotted double the hours as obstetrics. One or more times each week the student passes the day or night in the maternity wards. The theory is acquired from books and conferences. These are for the purpose of preparing the student for his examinations rather than for the practice of medicine."

Professor A. Martin of Berlin says: "It is very meritorious that you are giving this subject consideration in your Association. Obstetrics even today is not given the recognition in Germany that we instructors desire; this from the viewpoint of teacher and practitioner. We are not unmindful of the great difficulties involved in arranging a satisfactory curriculum for the study of medicine, due to the marvelous development of the medical science. In Germany the student is required to deliver but 4 cases which is manifestly too small a number and we are endeavoring to bring about a change whereby the student will be required to devote one month to the maternity wards and it is expected that this will be done."

Professor L. Fraenkel of Breslau, an honorary member of our Association, writes as follows: "Of late years surgery is encroaching on the field of obstetrics and some of the work formerly considered part of obstetrics is falling into the hands of the surgeons. Slightly more time is allotted to surgery than to gynecology and obstetrics; the proportion being 6 to 5. The ratio of obstetrics to gynecology is about 3 to 2. Besides, we require that every semester the students spend all their hours in the clinic and live there for a certain fixed period. During this time they are present at all deliveries and are instructed by the assistants and permitted to examine the patients. This is in addition to their other lectures and the clinic time devoted to obstetrics and is no longer than for surgery."

Professor Otto von Franque of Bonn finds it difficult to give the exact number of academic hours devoted to the teaching of obstetrics because, as he says, obstetrics is combined with gynecology throughout all Germany; that it always has been and he hopes it always will be. He expresses the criticism that in Germany too much emphasis is placed upon the scientific phases of the subject and not enough on the practical. Obstetrics and gynecology combined share nearly equally with general surgery.

Professor Pankow of Freiburg presents an outline of a very comprehensive schedule in obstetrics and it is apparent that all possible emphasis is placed upon practical clinical instruction. It is of interest, however, to note that a minimum

of 4 deliveries is required of the student, though some students will deliver 20 to 30 cases. Only two to three days are required in the maternity wards. The bulk of the clinical instruction is given in clinics conducted by the head of the department. Professor Pankow says that because of the growing importance of the problem of abortions in Germany, two or three students are required to attend every case. Regret is expressed that the students are not required to personally supervise more deliveries.

Professor H. Eymer of Innsbruck, says obstetrics in Austria is not on an equality with general surgery in number of teaching hours; about double the time is devoted to surgery.

Dr. Bernhard Aschner of Vienna feels that obstetrics, for the past 100 years, has been placed upon an entirely wrong basis. He argues that the teaching of obstetrics should be simplified and the hours shortened; that too much time is allotted to such subjects as embryology and histology, subjects that are superfluous to the general practitioner and only of interest to the scientific specialist. He says he is aware that the majority of professors in Austria and Germany would not subscribe to this criticism, but contends that his principles have proved themselves in private practice and voices the hope that his American colleagues will share in his views.

Dean Martin of McGill University says: "I feel very strongly that not enough time is given as a rule to obstetrics in most of the schools. Certainly it deserves, in combination with pediatrics, at least as much time as surgery. In our schools we have, I believe, as good an obstetrical service as anywhere in the world for the student body."

Professor W. B. Hendry of Toronto University is "not altogether satisfied with the small amount of time which is detailed to obstetrics in comparison with the number of hours of clinical instruction a student gets in surgery." The proportion, as stated by Doctor Cleland, is 65 lectures in obstetrics; 120 lectures in surgery; 85 clinical hours in obstetrics; 430 clinical hours in surgery.

Dr. J. Clarence Webster, my former chief and now Emeritus Professor of Obstetrics and Gynecology of Rush Medical College, says:

"Very few medical schools in the United States and Canada are in a position to give adequate training in obstetrics to their students. Consequently, in private practice childbed mortality continues to be higher than it should be, and morbid pelvic conditions produced form a large percentage of the diseased conditions from which women suffer.

"Theoretic instruction is excellent in many institutions. The need is for better clinical instruction. This may be obtained in two ways. Teaching Maternities, in which senior students may reside and conduct cases of labor under supervision, as in the famous Dublin Rotunda, are necessary.

"Outdoor district care of obstetric cases, also under supervision, should be provided in all schools. This method of instruction has long been a feature of the Scottish schools, and has been largely responsible for the high standard of practice among their graduates."

Dr. Fred C. Zapffe, Secretary of the Association of American Medical Colleges, writes in a personal communication:

"I am very glad that your Association is taking an interest in the teaching of obstetrics. For a number of years I have been trying to interest other associations in this question, but so far have failed in my efforts.

"As to the teaching of obstetrics: During an experience of twenty-three years of visiting medical schools I have gained certain impressions that have never varied, but have been multiplied.

"As a rule, obstetrics and gynecology are in one department of which a gynecologist is the head, as there are only a few obstetricians, and even if there were more, the gynecologist would insist on the headship of the department, or a separate department. Therefore, the bulk of the hours allotted to the combined department are taken by the gynecologist.

"I find that in many schools there is very inadequate provision made for training students in actual delivery work. There are very few well organized out-patient departments for obstetric teaching and hospital teaching is, with few exception, not adequate obstetric teaching. Students observe; they do not 'do.'

"I have been especially interested in this question because I have always been convinced that the teaching of obstetrics is wholly inadequate in most medical schools. I am convinced that obstetrics should be a separate department, in charge of an obstetrician, and that out-patient maternity work should be the backbone of the teaching. In an editorial published in the *Bulletin* of this Association, July, 1927, I advocated the abolition of the department of surgery in undergraduate medical schools and provision for a department of medicine and a department of obstetrics. In the October, 1927, issue of the *Bulletin* I published a cooperative curriculum in which I gave to obstetrics 140 teaching hours and four weeks of maternity work; more hours than I gave to surgery (didactic) and nearly as many as I gave to medicine (didactic)!

"I am not an obstetrician; I do not teach obstetrics, but I am firmly convinced that undergraduate medical students should have more obstetric experience.

"It is impossible to give to each fundamental subject in the curriculum the time it really should have; but training in fundamentals can be given in comparatively few hours if we stop spoon-feeding our students, attempt to direct, rather than to lead, them, and give them opportunity to do some thinking for themselves.

"It is necessary for every teacher in the medical school to recast his courses; to change his methods of teaching; to stop being didactic; to direct; assist and give to the student a little knowledge which will stick and make it possible for him to get more on his own. On inquiry I have heard it said over and over, that assignment of so many pages of a standard textbook for a quiz or a recitation (the same) is the rule. That is also true of obstetrics. You cannot teach all of obstetrics in an undergraduate course, even if you devoted a whole year to it, but you can teach the very much needed fundamentals and when expert help is needed, and stimulate some students to develop themselves further in that specialty.

"I may be in error, but I feel that what the student needs in obstetrics is more prenatal work; more delivery experience, in addition to training in making obstetric examinations and manikin work, with a very short course in the usual didactics. All rare and unusual things should be taboo. And all of this can be done in 140 hours and four weeks of maternity work.

"You and your associates have my good wishes in your attempt to do something for obstetrics, but, please remember, that there must be two courses of training: One for the undergraduate medical student who must practice obstetrics in the home, on the farm, or in a hospital, and the other for him who wishes to become an expert, a specialist.

"I will be very grateful to you for word as to what action, if any, your Association will take at the September meeting. Further, I want to assure you that I am very much in accord with special societies taking on the job of considering their teaching function; in fact, it is a duty for teachers to do that in their special societies. Heretofore, regard has been had only to the development of the specialty; but, inasmuch as there are not associations of teachers of this and that, nor of all teachers, it behooves the teachers who are members of special societies

representing their branch, to discuss teaching because only in that way can we even hope to solve the problem."

The theoretic teaching of obstetrics in America may be said to be fairly up to the standard set by other nations, but the facilities for clinical observation are woefully lacking in many of our institutions. Herein lies the explanation for the disgraceful showing we are making in the practice of obstetrics as compared with other nations. Baker tells us that the maternal mortality is one-third higher in the United States than in England and Wales and more than twice as high as in Denmark, Italy, Japan, the Netherlands, Sweden, and New Zealand. Dr. Brooke Bland is my authority for the statement that the United States ranks highest in maternal mortality among the 21 leading nations; that we have consistently maintained a rate in excess of six per one thousand from 1915 to the present time. And this from a nation that so blatantly boasts of its efficiency and of the magnitude of its institutions. In this connection we recall the fate of the dinosaur which from an architectural point of view was the largest and most beautiful of animal creations, but its body grew so large and its head so small it could not maintain its existence.

All will agree that the number of clinical maternity beds in most of our teaching hospitals is entirely inadequate for the proper training of students. But there must be more than clinical facilities provided; there must be time for the student to use them; time in which to live in an obstetric atmosphere. This cannot be done without a very radical pruning process on the part of those charged with the responsibility of portioning out the students' time. The curricula of our medical schools and of our premedical institutions are literally jammed with irrelevant subjects which have no bearing whatsoever on the practice of medicine. Far too much emphasis is placed upon clinical subjects which might better be shifted to graduate schools. Indeed, it would seem that between the theorizing of the Ph.D.'s of our faculties and the gormandizing of the general surgeons, the obstetrician has done well to maintain a semblance of individuality.

Permit me to submit to you the following propositions for your consideration:

1. If it is the business of our undergraduate medical schools to prepare students for the general practice of medicine, it follows that obstetrics should have a large place in the curriculum.

2. In the general practice of medicine obstetrics far exceeds that of general surgery in importance and is only second to that of internal medicine. Such should be the relative positions of these subjects in the curricula of our schools.

3. The demand in numbers of academic hours upon our medical students is already excessive and should be reduced. To provide more

time for clinical instruction in obstetrics, without adding to the burden of the student, the didactic teaching in obstetrics, as well as in all clinical subjects, might well be restricted to the fundamentals; much of the teaching in general surgery should be shifted to graduate schools and far less emphasis should be placed upon minor specialties.

4. The need is for more practical instruction in obstetrics and this can only be attained in hospitals and dispensaries. The service in the out-patient department, as commonly conducted in our institutions, is no adequate substitute for the dispensary and the hospital.

5. Not less than one month should be devoted exclusively to a maternity service. In this service the student should deliver a minimum of 20 cases, under the direction of trained clinicians; and the importance of prenatal supervision should be stressed.

6. Everywhere throughout the world it is apparent that the teaching of obstetrics is receiving more and more consideration. The medical schools of the United States are lagging far behind most schools of the world in practical instruction and this for lack of adequate clinical facilities and the time to devote to it. There must be a revamping of the entire curricula in our schools to the end that our students may be better prepared to meet the demands of the general practice of medicine.

7. The maternal morbidity and mortality, which in the United States has not decreased in the last fifteen years and is today the highest of the twenty-one leading nations, is chargeable to educational defects and will not be materially reduced until our institutions provide more adequate clinical facilities.

8. From my correspondence (see appended résumé)\* I learn that the countries in which part or all of the institutions give obstetrics and gynecology combined, equal recognition with general surgery are Russia, Poland, Ecuador and Argentina; that in Germany, France, Norway, Sweden, Holland, Italy and Switzerland the allotment is nearly equal; while England, Scotland, Wales, Canada, Australia, Egypt, Finland, India, Cuba, Czechoslovakia, Chile, Peru, Brazil, Austria, Hungary, Mexico, China, Siam and Haiti give much more time to surgery than to obstetrics and gynecology, the proportion being about 2 to 1. However, it is of interest to note that in none of these countries is surgery given so large a proportion of the teaching hours as in the United States where the ratio of surgery to obstetrics is in the neighborhood of  $4\frac{1}{2}$  to 1.

9. The American Association of Obstetricians, Gynecologists, and Abdominal Surgeons respectfully petition and urge upon those who are in official command of the situation to remedy this state of affairs.

\*For lack of space the details of Dr. Findley's questionnaire addressed to deans of medical schools and professors of obstetrics, can only be included in the Association's current volume of transactions and in the author's reprints.

We ask this with no desire to unduly exalt ourselves or our specialty, but for the purpose of preparing our students for the responsibilities of their chosen profession.

And Israel spoke unto Rehoboam saying: "Thy father made our yoke grievous; now therefore, make thou the grievous service of thy fathers, and his heavy yoke which he put upon us, lighter, and we will serve thee."

## THE TREATMENT OF CERVICITIS, PARTICULARLY BY THE CAUTERY AND OPERATION\*

BY FREDERICK C. HOLDEN, M.D., F.A.C.S., NEW YORK

(From Committee on Maternal Health)

THE treatment of the most frequent and persistent of the pelvic infections is a present field of active discussion. An evaluation of the various claims is therefore in order. For such a purpose we may compare the results obtained in a service amply provided with obstinate examples and operative opportunity like Bellevue Hospital with those in an office fully equipped for local treatment. This inquiry is aptly reinforced by items from a special study covering 500 case records among one group of private patients turned over to me by our Committee on Maternal Health.

This paper takes up some clinical issues relating to cervicitis in the groups in which the cautery seems to be particularly indicated; namely, in the virgin, between labors, and at or near the menopause; cervicitis of the cystic variety, the form accompanied by polyps, obstinate gonorrheal infections, and erosion with precancerous suggestion. A new indication is taken up; namely, the healing of the cervix before operation in order to lessen the amount of surgery. The main group, however, comprises those women whose chief pelvic disorder is an uncomplicated inflammation of the vaginal portion and the canal.

The varieties of cervicitis, where the cautery is not indicated or where it is unnecessary, are the following: (1) the considerable group in which the disorder is but one of several, for which operation is called for, as with laceration of the pelvic floor, tumors, or retroversion with symptoms; (2) the relatively slight inflammations, neither granular nor everted; (3) the simple edemas; (4) the few cases found to do better on other treatments after trial of cautery; (5) cervix inflammation in very sensitive or hysterical individuals who are bad subjects for office care; (6) a congenitally long *portio vaginalis*, only curable by amputation; and (7) the uncomplicated cervicitis given to more or less frequent relapse.

\*Read before the American Gynecological Society, Washington, April 30th, 1928.

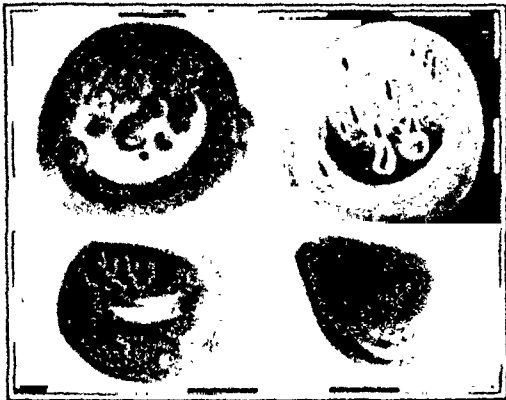
A



B



C



D



**A.—Vaginal and Senile Cervicitis.** (1) Cervix in an actual virgin, with sharpened, one finger hymen. (2) Cervix of actual virgin with eversion and stimulation of laceration. (3) Senile cervix with healthy vaginal portion yet with conditions shown in 1. (4) Multiple cysts high up in canal in woman of seventy-five years (after Christeller).

**B.—Steps in Treatment of Cervicitis.** (5) Laceration with eversion and raw surfaces apparently calling for operation where surgery is postponed until other babies should be born. (6) The same with cautery treatment by the narrow platinum loop. (7) Condition three weeks later calling for second application. (8) Shrinkage, inversion and healing rendering operation unnecessary; but recurrence after next child called for repetition of treatment.

**C.—Cysts, Varicosities and Conical Cervix.** (9) Cystic disease of lacerated cervix, with cysts located within canal and on lateral surface of vaginal portion. (10) Cautery opening of the cysts, with clear mucus hanging out of two incisions. (11) Varicosities of cervix on posterior and on anterior lip shown, for convenience, on same cervix. (12) Conical cervix with healthy surface, the cavity blocked with mucus.

**D.—Cautery and Dilatation in Cervical Canal.** (13) Small external os, high cysts, dilated canal plugged with mucus. (14) Slough protruding from external os a few days after cautery. (15) Nasal cautery treatment of diseased canal; arrows show area being cauterized. External os has had preliminary dilatation. Fine loop or spiral tip of nasal cautery does not burn external os, and thus stenosis is avoided. (16) Same canal as 15 with the Postcautery demonstrated, showing, by arrows, an unavoidable cauterization of external os, producing stricture.

The frame of each cut is laid out in centimeters on the sides and half-inches at top and bottom to show the scale.





## I. INDICATIONS FOR THE CAUTERY

*Virgins.*—In a series of 500 cases of cervicitis in private practice, it was found that one out of five occurred in unmarried women, 85 of this 100 having hymens so small and sharp-edged as to be classed as verifiable virgins. It is a serious matter to undertake a long series of office treatments in single women with an ailment essentially chronic and prone to relapse. If the cautery holds out the promise of substituting 2 to 4 treatments spaced two to three weeks apart for a course of bi-weekly treatments covering two to four months, the cautery claim for this field is well founded. By the former, fewer office habitués will be developed and less erotic stimulation will be aroused. By the use of a virgin speculum and the narrow beam headlight the hymen is undamaged and the nerve strain often associated with local treatment is minimized. (Fig. A, 1, 2.)

*Between Labors.*—A considerable proportion of parous women present a raw cervix during lactation or thereafter, with leucorrhea and some pelvic discomfort. (Fig. B.) We have learned to realize that one woman in five may have a postpartum retroversion, and we have shouldered the obligation by systematic search for, and treatment of, this disorder. But *routine investigation for a raw cervix after labor* has not yet become a standard responsibility. When such search finds a granular exerted external os with or without laceration and edema, the alternatives of temporizing or repairing face us. The patient desires other children. She is likely to present the same condition of the cervix after each labor. The time when operation gives permanent results is when she is through having her children. Then repair of the cervix will be combined with repair of a pelvic floor and operative correction of any retroversion. In recurrent cervicitis of parous women we have in the cautery therefore a nearly ideal method for healing and inversion with a minimum number of office visits. Such treatment interlocks preferably with the relief of displacement by pessary support.

Goodall drew attention to the puerperal morbidity due to latent infection in uncured cervicitis of pregnancy in a lecture before the New York Obstetrical Society, March 16 of this year.

*Senile Cervicitis.*—The small vulva and sensitive vagina of the woman beyond the menopause (one who is not having regular coitus) presents some of the same reasons for a thorough but infrequent treatment. If this new field develops as it appears to promise, and cysts within the canal coupled with a narrow external os are the main cause, dilatation of the external os and the fine cautery wire tip in the canal would appear to be the best treatment. Postclimacteric cases do not comprise over 3 per cent of our list. In these patients the polyp as a cause is never out of our mind. (Fig. A, 3, 4.)

*Cysts*.—These occur either alone or in conjunction with raw surfaces. (Fig. C.) In cervicitis cysts were found in one case out of four. Of 125 cystic patients 25 were treated between the ages of twenty and thirty, 58 between thirty and forty, 40 between forty and fifty, and 2 between fifty and sixty. Half of the total number were treated between thirty-three and forty-three. The tendency to relapse was marked. The cysts are sometimes left-overs after healing of an eroded cervix, bringing a patient back at intervals of months or years, whenever she recognizes the recurrent ache or dysmenorrhea from their tension. These do not often justify operation in and of themselves because the relapses are of a minor degree, as a rule, once the larger cysts have been eradicated. *Cysts high in the canal* are a new study. Dickinson is finding, since his paper was read in November, 1927, such location to be even more frequent than he supposed. It need only be said here that the high location of some of the large groups of cysts at or even above the internal os would, if removed by the Sturmdorf method, require so extensive a conical excision, and a near-cylinder so large at its upper end, as to constitute a strong argument for a preliminary trial of the electrocautery tip. Whenever other operative measures are necessary a cervix riddled with cysts may well be amputated. There are, however, conditions in which these other operations may need to be deferred. In such cases cysts of the cervix may well be punctured. Then when the time for operation arrives the months that have elapsed with no recurrence of cysts may show that a cervix operation is not needed.

*Polyps*.—As these growths are conveniently treated by the cautery, application of the hot wire to the inflamed or infected surfaces in the neighborhood is indicated. Two or three weeks later, when using the cervical endoscope to look at the base of the polyp, a second application of the hot wire will be made if required. Bishop believes that malignancy is not infrequent with polyps, but Dickinson found only one such diagnosis in 106 polyps sectioned. Whether there be a large or small danger of cancer in connection with polypoid growths, the indication for treatment by the cautery is very strong as it is the method next to radium in value for ability to limit or prevent malignant growths. Attention should be drawn to the frequency with which polyps occur at and near the menopause.

*Chronic Gonorrhea*.—Among the private patients upon whom the statistical study is based, there were smears or cultures early in the series. We had the usual experience of discouragement from single smears and repeated smears. In women with clear histories or adequate clinical findings smears were largely abandoned. Vigorous treatment damaged the diagnostic value of smears. We therefore have in this series few cases which are classed as gonorrheal by microscopic tests, only one in ten among the married women. No doubt a

very considerable number even in this private practice had their origin from the gonococcus, but Curtis has shown that the active agent in a long continued inflammation hereabouts is no longer the original offender. In any case we are concerned with the cure of the chronic cervix rather than with the cause. I am convinced that no method of treatment compares with the cautery in relieving the obstinate cases proved or supposed to be gonorrheal in origin.

Naturally the cautery is not used in the acute stage or in persons with tender tubes. I have never seen a salpingitis or peritonitis lighted up or renewed from the use of the cautery within the cervix. However, this may be due to the practice of beginning with a moderate trial treatment to ascertain the patient's reaction to treatment wherever doubt exists. Other measures such as diathermy or tampon are sometimes used first where the main complaints are due to adherent tubes.

*Prevention of Cancer.*—Since the American Society for the Control of Cancer began to educate the public, more women are coming to the gynecologist to be examined. Cervicitis which is not active enough to produce a leucorrhea or dysmenorrhea or other discomfort is thus brought to our notice, indicating that this chronic and mild disorder may have lasted for years. Simple treatment like silver nitrate or full strength pyroligneous acid will usually suffice, but the cautery is needed for cystic or granular conditions. The new practice of the gynecologist of following up his former obstetric patients or those who have been treated for cervicitis and sending for such as have not been cared for by himself or others, and the healing and keeping healed of the cervix may have an important effect in preventing cancer. In the series studied, a singularly low incidence of malignancy has been shown among the 500 cases. Three unsuspected cancers were detected among the 313 parous women, all being found at repair operations. There have been several cases apparently along the border line where there has been some reason for not operating and obtaining a specimen. Here it is inferred that a thorough-going treatment with the hot wire would destroy any very superficial cancer. It goes without saying that no case with clinical evidence, such as friability or bleeding after sulphate of zinc, escaped biopsy or diagnostic curetting.

*Cautery as a Preliminary to Operation.*—In certain selected cases, as a deliberate first step, I have opened cysts or healed raw areas, with the purpose of lessening the amount of operative work to be done, postponing the surgery until healing and shrinkage had occurred. Thus one is able to forego one of the series of operations to which the patient would otherwise have been subjected. I was led to do this by the number of instances in which a patient who evidently needed a cervix operation had to postpone such an operation and

was given palliative cautery treatment while awaiting operation. In a surprising number, when the time for Sturmdorf or amputation or repair arrived such an amount of inversion and shrinkage and such sound healing of the surface had occurred that one had no reason for resort to surgery.

*Minor Indications.*—Large vessels on the surface of the cervix are rare but constitute a definite reason for use of the hot wire. Care is taken to keep the heat very low in order to shrivel and not cut through the vessel. Where the vaginal portion clearly shows projecting veins it is to be presumed that the same condition exists within the canal and cautery treatment along two interior faces is desirable.

The conical cervix is to be watched for because defective drainage and a pinhole os are likely to be associated, and infantilism and sterility are not unusual accompaniments. Any leucorrhea under these conditions would lead one to suspect blockade. An innocent looking opening may have behind it a cavity as big as the last joint of a man's thumb, distended with tenacious mucus or mucopus. Under such conditions the importance of dilatation cannot be overstated.

## II. CONTRAINDICATIONS TO THE CAUTERY

Except as an occasional preliminary I do not use the cautery for the infected or cystic cervix where other operations are needed, as for tumors, tubal disease, retroversion or plastics of the vagina or pelvic floor. Under such conditions the cervical operation is combined with the others. However, if there be no surgery to be done below the cervix, such as repair work, and the cervix can be cured by a couple of treatments, then there is a distinct advantage in healing the cervix by cautery, so that the work in the operating room may be from one point of attack only, the upper or abdominal route.

*Simple Forms.*—Where the cervix presents only superficial inflammatory or infected processes or where dilatation of the external os is the sole requirement to better the drainage from the canal, cautery is not needed and simple applications like silver nitrate of a strength of 5 to 15 per cent suffice.

*Nervous Patients.*—There are highly nervous patients unsuited to a treatment which may give pain. The hysterical are ruled out and also the individual on whom novocaine (5 per cent in adrenalin solution) fails to bring about bleaching and local anesthesia. A course of very gentle applications, or operation, may be wiser selections for these individuals. There are a very few instances (1 in 55) which have shown better results with other local treatments. Apart from recurrence due to labor there are a few relapses where removal of the infected area is necessary.

*Diathermy.*—The merits of this method of treatment of cervicitis have not yet been satisfactorily established. The electrode within the

cervix carries heat up to 116° F. which is said to kill the gonococcus. With a full installation in the office, a year's use has shown some excellent results in the treatment of certain products left after acute pelvic infections, particularly by the relief of pain and removal of exudate. I have not used diathermy for cervicitis because of the satisfactory results achieved with the incandescant wire.

*Radium.*—Curtis states that he has abandoned radium in the treatment of cervicitis for more than two years because he felt its action was difficult to control and contraction occurred at times. The cost, the exact skill required, and the hospitalization also militate against radium.

### III. CAUTERY METHODS

The simplest method is that of Abrams, who heats the tips of a uterine dressing forceps to a cherry red heat in an alcohol flame and applies this to the affected surface. A circular slough up the canal may produce stricture. The most generally adaptable and workman-like tools have, however, long ago been developed for use by the rhinologists. The delicate narrow platinum loop and the spiral tip nasal electrode provide entirely satisfactory burning surfaces with which to apply heat that can be perfectly regulated.

The only advantage of the Post cautery is that for \$25 it can be attached by its rheostat to any electric light socket, whereas the nasal electric cautery requires a rotary converter as well as rheostat for the direct current, and a rheostat alone for the alternating current, at a cost of \$85 or \$35 respectively for the entire equipment. Wappler has a new device for both light and heavy cautery at \$120. But though the Post cautery works well on surfaces in view, within the canal it has done harm for the following reason. The heat cannot be restricted to the tip where the work is to be done. Unlike the nasal cautery with its insulated shank, the shank of the Post cautery becomes so hot that the external os is burned (Fig. D, 16). The closures of the cervix reported to Dickinson and myself are cases after use of the Post cautery, and the literature has cases from the Hunner treatment with the Paquelin cautery. Cashman, who uses it, systematically has to dilate after cauterization to prevent contraction.

In one series of 168 cases treated by the cautery the interval averaged two weeks. Three or four week intervals may be preferable in a majority of cases. The average number of treatments is two to four. Obstinate infections far up the canal may require more frequent and lighter treatments.

A new study is under way to determine the thickness of the mucous membrane of the cervix in order to learn to what depth the heat of the cautery should penetrate or the amputating or coning process clear away the chronically infected lining. A review of 26 sections

which give some evidence on this point indicates that 5 mm. is not an unusual thickness and that few mucous membranes are less than 2 mm. in depth.

It is better to apply the wire first to the posterior lip, so that the occasional oozing will not fall upon the surface yet to be treated. It is to be noted that the cautery treatment is applied to the external os or deep within the canal on much the same principle as when surgical removal is brought to bear on hemorrhoids. Strips of anal mucous membrane, even though narrow, are left behind in order that stricture shall not develop and in order to provide for rejuvenation of surface epithelium. The tissues intervening between cautery stripes are probably sterilized by the irradiated heat within a radius of 3 to 5 mm. as shown by Polak and Matthews.

Patients are to be warned that some bloody show may occur in a few days and that malodorous leucorrhea will appear, requiring a few days of douching.

#### IV. POINTS IN DIAGNOSIS

Finally, there are three elements in diagnosis to which attention should be drawn: time, light, and deep search.

First, there should be, as part of one's routine care of a patient, an inspection of the cervix for raw areas or cysts at these occasions: (1) a month or two after delivery, and (2) again at the end of nursing; (3) when a woman is through having children; (4) always in the presence of a leucorrhea; and (5) in the years approaching the menopause.

In the second place, a proper search involves the best possible illumination of the cervix. Except in the gaping vulva or wide introitus accurate visualization of the cervix can only be had by the use of the headlight, and such a headlight as will focus a beam strongly upon it. Dependence upon light from a window or upon the large lamp on the forehead cannot yield proper conditions for adequate attention to all cysts, to the stalks of polyps, nor any exact observation of surfaces and discharges. As with the ear and the throat, the darker the room and the more concentrated the illumination, either from a focusing headlight, or from the lamp within the speculum, the more exact is the work.

Third, for our new studies of the canal we shall probably need to return to the old tubular cervix speculum.

#### SUMMARY

The electric hot wire eliminates many cervix operations and long courses of local treatment (and the fees consequent) being especially adapted to uncomplicated raw areas, to virginal, senile, polypoid and cystic forms, to obstinate infections and cysts up the canal; to ero-

sions between labors; and to eliminate or to lessen amount of cervix surgery in multiple operations.

Plastic surgery is called for where other operations are needed, for long conical cervix, for obstinate relapses, and where local applications suffice for simpler conditions and edemas.

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59 EAST FIFTY-FOURTH STREET.

(For discussion, see page 710.)

## PREMARITAL EXAMINATION AS ROUTINE PREVENTIVE GYNECOLOGY\*

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(From Committee on Maternal Health, New York City)

**E**XAMINATION for fitness has become customary for all occupations save marriage and parenthood. Eventually common sense may be expected to demand a similar preparation before deciding on matters so important to the life of the individual and the race. There should be developed a public opinion in favor of routine consultation on major physical defects and psychic inhibitions before the announcement of an engagement, followed by a general and local examination of both bride and groom a month or more before the wedding day is fixed. At the present time we may at least formulate plans for such a practice, and this formulation should be one of the basic concerns of an independent research body like the Committee on Maternal Health, whose major function is to investigate and report upon the relatively neglected medical aspects of human fertility.

While not omitting reference to legislation regarding examination before marriage, and prescribed forms of certificate, we purpose here to urge upon the medical profession its obligation to assume a social attitude toward those aspects of marriage which are within its province. Responsibility for the sound growth of public opinion rests finally upon the technician. It is he who must work out sane tests and develop the details of useful instruction as the foundation for beliefs which shall be built into the customs of the people.

\*From a paper read April 23, 1928, before the American Gynecological Society.

For lack of space, certain portions of this paper had to be eliminated, but the complete paper appears in the current volume of the transactions of the American Gynecological Society and in the author's reprints.



To this end examples are given of advice to prospective bride and groom looking toward the prevention of fear and painful intercourse, of physical maladjustments and frigidity, and of preventable chronic irritations likely to produce unhappiness in marriage. The physician makes a special point of trying to detect and remove misgivings. His general examination includes search for defects and symptoms of communicable or hereditary diseases, and then study of the woman's genital and pelvic anatomy with reference to marriage and childbearing. Instruction is given regarding conjugal relations, first on the differing psychology of men and women, and second, on certain elementary matters, basic for the newly married, including the wise spacing of children. The man *may* be referred to a urologist for examination and instruction, but on the whole it is found better to have both cared for by a single physician.

The study that follows is built upon the case records of some forty-five years in general gynecologic practice. It grew out of the fact that maladjustments focussed at certain points. These points were gathered together as the basis for a premarital talk. Whenever a patient has said that a certain difficulty might have been prevented "if I had only been told," that item has been included. Secondly, intelligent couples instructed before marriage have been asked to report after some months or years on those sections or details which proved to be useful, and those unessential, in the talks that had been given them. Thus, nearly every clause of the set speeches made separately to the bride and groom has grown out of a need brought to light through some unnecessary, and perhaps grievous, misunderstanding. I have gone out of my way to do this, and made it my practice to give the instruction without a fee. The offer rarely is declined.

#### I. SOCIAL POLICY

The formulas for permission to marry—problems of family and tribal custom which began before man could write—appear in contemporary history chiefly as books and articles on legal questions and general policy.

There are excellent symposia from a foreign point of view in Senator and Kaminer's "Marriage and Disease," 1904;<sup>12</sup> in "Das ärztliche Heiratszeugnis" in the "Monographien für Frauenkunde und Eugenetik," edited by Max Hirsch, 1921;<sup>7</sup> and in "L'Examen Medical en Vue du Mariage," 1927, written by a group of European authors, mainly French.<sup>10, 11</sup> We have a recent American study of certification by F. S. Hall.<sup>5</sup>

Social practice varies both with respect to the degree of government initiative and control, and also as to the sort of guarantees expected. Thus, certain states require a certificate of fitness for marriage.<sup>10</sup> Among these are Sweden (1915), Norway (1919), and Denmark (1922),

which call for a declaration by the couple covering mental trouble, epilepsy, venereal disease, leprosy, consanguinity, previous marriage, and children born out of wedlock. The doctor (released from obligations of professional secrecy) only comes into the picture to register the declaration. Turkey, in a recent law, demands medical examination by a doctor especially designated, and goes so far as to have a seal placed on the wrist of the applicant to prevent the substitution of another individual. In Armenia, examination has been obligatory since 1920. Germany requires both applicants to reveal to each other what communicable diseases they have had, annulment being granted for deception.

As an example of persuasion rather than enforcement, we may cite Holland, where there is a society in favor of prenuptial examination, with forty-one active committees. Examination is not compulsory, but the society's circulars are given out by government bureaus on publication of the banns. Amsterdam has a prenuptial consultation office. So have Brussels and Antwerp. Germany, by the law of 1920, began in 1922 to deliver to applicants for licenses a circular advising medical examination. At least eight marriage-advice stations are in operation, chiefly in public health offices, in Berlin, Hamburg, Dresden, Frankfort, Magdeburg and Linz. The Berlin Medical Society (1926) endorsed a report drawn up by Max Hirsch condemning obligatory exchange of certificates, but favoring a law to make medical examinations of both sexes compulsory, under any physician, and not by designated experts, with safeguarding of professional confidences.

In Austria elective medical examinations have been in operation since 1922, beginning with an appropriation of 300,000 kronen a year. While only about one hundred persons appeared the first year, twelve hundred are now advised annually, the Krankenkassen carrying certain laboratory costs. Dr. Novaks, active in this matter, informed me in 1926 that these examinations were functioning well. In Italy the proposed Red Cross station at Milan plans such secrecy that the candidates need not even give their names.

In France and Belgium, according to Dr. Georges Schrieber,<sup>11</sup> public opinion is resolutely hostile to any constraint in the matter. He urges that such examinations should enter into custom before going into code. He favors, first, government distribution of notices to all candidates for marriage, and second, opening stations for advice in the largest possible number of cities, either as a municipal charge or under private auspices. In England, the president of the Eugenics Society, Major Darwin, thinks one should not attempt to go further than to demand from each party the declaration of a belief that he or she is free from certain specified infectious diseases and has never been confined in an asylum or prison, but advocates that marriage of a certified lunatic or anyone mentally defective be made punishable.

The general trend of the recent discussion which has been active in Germany, France and England has been in favor of awakening the public conscience rather than attempting to write laws. The purpose, says Hirsch, is not to crystallize a decision concerning forms of prohibition or permits, but to encourage the "nupturients" to face the health issue as frankly as they would questions of income and social standing.<sup>7</sup>

## II. PHYSICAL EXAMINATION

The contribution to sex hygiene made by the physician, and especially the gynecologist, is directed particularly toward the prevention of dyspareunia, vaginismus, frigidity, abortion, sterility, unwise postponement of childbearing, and difficult labor, and the lessening, so far as lies in his power, of the causes of divorce and adultery.

*General.*—The patient's history indicates where the emphasis should be placed in each particular case. With a neurotic family or personal history, especial attention will be given to the nervous system; with a tubercular or cardiac heritage or symptoms, these possibilities will be stressed. Endocrine imbalance will be considered. The standard tests to be made in these lines, as for gonorrhea and syphilis, have been adequately covered in the books already referred to, and need not be repeated here. The psychic factors are considered at some length in the chapter on dyspareunia, in the volume on gynecology and obstetrics of Nelson's Loose-Leaf Surgery, now in press.

After the ordinary general examination—weight, blood pressure, heart and lungs—the patient prepares herself for pelvic examination by removing the girdle and emptying the bladder.

While making the chest examination, attention should be given to the breast and nipple. Then follow abdominal palpation and external measurement of the pelvis ending with the transverse diameter of the outlet.

*Pelvis.*—Those who hesitate to examine the unmarried woman are reminded that all information desired about position and size of uterus and ovaries is obtainable by rectoabdominal bimanual palpation, and that a Sims speculum need be no larger than one finger, provided a narrow beam of light is used to inspect the cervix in cases of leucorrhea or dysmenorrhea.

Anatomic observations as to the funnel of entry, the hymen, the vagina, the meatus, and the reaction of the pelvic floor muscle group, are made as a routine after considering the adequacy of menstruation and the sufficiency of external pelvic dimensions. The possible abnormal conditions to be borne in mind are: absence of uterus and vagina; retroversion, antelexion, and particularly infantilism of internal and external genital organs; ovarian tumors, myomas, and their size and location; infected urethral glands and eroded cervix; and the after-effects of any operation or delivery.

An ovarian tumor would call for operation before marriage. Small fibroids might only hamper fertility. Firmly adherent tubes would indicate present and probably future sterility, but Strassmann warns against too definite prophecies of sterility from moderately defective menstruation, anteflexion, infantilism and fibroids.<sup>13</sup>

In sterility tests, the male presents a simpler problem. One puts up to the man very directly whether he will prove his fertility or not by a self-produced friction specimen for immediate microscopic test. While active, well formed, full sized sperms show the strongest evidence of fertility, scanty numbers, smallness and sluggish actions may be due merely to fatigue or recent emissions. With such findings, one or perhaps several further tests are made before a statement is included regarding fertility.

There are no data showing the range of genital proportions in either sex, and there is no indication that these variations are often so extreme as to simulate the abnormal. While it is generally stated in the anatomies that there is a marked variation in the diameter and length of the erect male organ, search has failed to reveal a published table based on a series of measurements. Distensibilities of vulva and vagina have already been charted;<sup>4</sup> their measurements and conformation in the living will be published later.

*Introitus.*—There are a number of married women in my series in whom impending coitus calls up persistent memories of early painful experience. In order to prevent pain with the first coitus, and its permanent psychic effects, the hymen is to be studied. A hymen about one finger in size with an edge that gives a definite sensation of sharpness to the finger, with an evident sensitiveness on the part of the patient, denotes verifiable virginity and what Strassmann calls "anatomical virtue."<sup>14</sup>

With a hymen of the usual build, thin and admitting one or more joints of the ordinary male forefinger, a very moderate course of douching and stretching will cause it to become elastic enough to prevent pain with the first coitus.

The hot douche every night for ten or fourteen days will relieve tenderness, and daily or so for a month, will produce sufficient relaxation to admit the phallus without tearing, particularly if desire is fully aroused, with its consequent relaxation and self-lubrication. There are virgin hymens torn by ungentle office treatments. There are untorn hymens that have been extended by the use of the douche or speculum, or that have been gradually stretched, either through manipulation by the fingers or entry by the male (more especially by the fiancé), and in a few instances untorn, unnickcd hymens have been seen which are distensible to any degree, even to the passage of the whole hand. This distensibility has been touched upon elsewhere.<sup>4</sup> Such findings will modify our instructions.

There is distinct value in a degree of distensibility which does away with inhibition or fear. Certain patients with hymens that promised to yield to stretching and yet were markedly sensitive, have been asked to try, shortly before the marriage, self-stretching of the hymen with one or more test tubes, or with one, then two, then three lubricated fingers. This dilatation, as well as the douche nozzle, does away with the kind of nervous apprehension that may end in vaginismus in a young woman whose hymen has never been penetrated. The considerable evidence in these records showing extreme distensibility of the unnicked hymen subjected to gradual digital massage by the girl herself or by a woman friend (up to diameters of 9 cm. or 3.5 in.) shows that nothing is more effective in overcoming sensitiveness or to prevent tearing. Whether this self stretching has an implication of impropriety which would make it more undesirable than dyspareunia, is a question to consider.

The *thick* hymen with small opening is likely to be inelastic. As a rule it should be cut, under a local anesthetic, ten days or so before the marriage, so that the cut surfaces will have a chance to heal over. This is particularly necessary where the fossa is deep. My own series shows nineteen women still virgin after one to twenty years of marriage, one wife in about 250. In seven of these virgin wives, the redness and depth of the fossa demonstrated that the glans penis was sidetracked into this pocket.\*

*Funnel of Entry.*—Infantilism presents the most poorly developed funnel and obesity the deepest. Women otherwise well developed may have tiny genitals; such defective development, more than any other finding, calls for douching and stretching. Finally, the prepuce is drawn back to note adhesions or smegma, and if necessary, should be freed with a small probe.

Much has been written concerning the location of the vulva, either forward and accessible, or to the rear and out of reach, and fanciful comparisons have been made in this regard between animals and primitive peoples.<sup>5</sup> My search among 50 anatomic midsections and on living women discloses no such grouping; on the contrary, the introitus maintains a singularly stable position in relation to the pubic arch. It is all a question of spinal curve and pelvic tilt; that is, the outlet of the bony pelvis, by its slant in one direction or another, determines vulvar accessibility and any apparent backward or forward placing.

*Vagina.*—A series of measurements and drawings of 160 vaginas in our records fall into the well-known classifications. Besides (1) the average, these are chiefly, (2) the infantile vagina, (3) the short va-

\*It is known that an adult male wedded to a young girl, as sometimes happens in India or Persia, may in rare instances drive on in this direction and create a false passage so that he enters the rectum through the perineal body " ".

gina of retroversion, (4) the long vagina of anteversion, (5) the sub-involuted, and (6) the relaxed or distended. In retroversion the glans may pass into the lateral fornix and find ample room. The size and position of the uterus at the premarital examination, therefore, give useful information concerning this passage. Warning should be given, in case of displacement or flexion, of the possible need of treatment should coitus continue to produce discomfort, and especially deep discomfort.

Among 140 cases of dyspareunia, a vaginal meatus has been found seven times as a cause. On drawing the vulva apart in these cases, the urethra is seen to converge with the vagina, with little or no distance between the vaginal opening and the meatus proper, or else actual location on the anterior vaginal wall. Such a meatus may be pushed inward and get caught between the penis and the sharp lower edge of the subpubic ligament. When this is recognized before marriage, it may be suggested to the groom that either rear entry or the dorsal posture with flexed thighs—that is, with the woman's knees up towards her shoulders—will keep the meatus from being nipped. This abnormality is to be distinguished from inflamed meatus, which also causes painful intercourse, and of which the same series of cases provides five instances; this is in addition to caruncle, an occasional cause belonging to a later age.

*Vaginismus*.—Within the hymen is the second possible barrier to the entrance of the male. Spasm seems to affect the pelvic floor muscles as a group rather than any particular muscle or set of muscles. As the pubococcygeus section of the levator constitutes the largest muscular entity, it is convenient to designate all of the muscles that take part in vaginismus as the levator group.\* The examining finger, having passed the hymen, finds on the posterior vaginal wall muscular obstruction in an inch-wide transverse band with two thickened edges. If not palpable, the request to the patient to obstruct the entrance of the finger will usually make it so. Only when the muscle groups go into spasm during examination need vaginismus be feared. Under such conditions, the patient may have to be treated from the point of view of her general state, her inhibitions or her local sensitiveness. I have never seen any need before marriage of incision of the muscles. If it is done, the cut should be made like a subcutaneous tenotomy, with a narrow, thin-bladed bistoury. Vaginismus is preventable. Removal of apprehension, prevention of pain, adequate rousing of desire, and self-dilatation can be relied upon to do away with spasm, except in rare cases of this relatively rare disorder. In the future its presence will be evidence of neglect of preventive measures.

\*Details of anatomy in vaginismus, with sections and clinical measurements too late for inclusion in a preliminary paper, will be presented in a future study. Twenty-five drawings will appear in a forthcoming volume of *Nelson's Loose-Leaf Surgery*.

## III. INSTRUCTIONS TO THE WOMAN

For the woman, three kinds of instruction mainly are needed: first, the rational preparation for a freer life through the allaying of fears and release of inhibitions; second, the assurance that her responses can be as full and satisfactory as her husband's; and third, removal of the fear of becoming pregnant at a time when it would be a risk to health or happiness, by instruction in conception control.

The first discussion may well precede the physical examination.

In a gynecologic examination, the evidence of the vulva yields an important clue to the type of instruction to be given the patient and the husband. Free mucus secretion is a good augury for sexual responsiveness. Hypertrophies of the labia minora and their degree of cockscomb corrugation indicate the extent of autoerotism, which, if not too set as a habit, also augurs well for proper response. Atrophied folds of former enlargement show capacity long antecedent, now, perhaps, in abeyance.

There is sometimes apprehension that early habits, such as autoerotism, may have set up mental balks or brought about incapacity for normal response. It is therefore desirable to state without questioning that the average or normal experiences of autoerotism or self-relief have rarely done any harm or hindered the happiness to come.

Whatever may be said to the man about the danger of quick emission can be paralleled to the woman about the danger of frigidity, and all the instructions to him about suiting his initiative to her psychology can be matched by urging her to cultivate responsiveness.

## IV. INSTRUCTIONS TO THE MAN

*Quick Emission.*—I believe it is best to tell him quite definitely the fact as shown in my 1000 sex histories; i.e., that no single maladjustment is so frequently found as quick emission in the male, associated with, and perhaps the main cause of, frigidity in the female. In the beginning he should consider a quick emission as not unnatural. Impotence or instant ejaculation may result from nervousness. This, however, should come right later. If it does not, he is to treat his trouble as important, in the sense that the future, as regards successful intercourse, depends upon it. If he can remain only two or three minutes in the vagina, and in this brief period his wife cannot be brought to the climax through proper preliminaries or genital caresses, he must consider his shortcoming serious enough to demand examination and treatment. I have seen the condition cured by relieving irritability in the posterior urethra—particularly at the verumontanum. This is a matter for diagnosis and treatment by the urologist.

*Adapting Initiative to Wife's Psychology.*—A woman of refinement, unless she is swept away by passion, requires or desires certain pre-

liminaries. Her zones are three: the mental, the surface erogenous area, and the vaginal; while his interest quickly concentrates at the latter. The mental zone is stimulated by loving words and an atmosphere of tenderness. The second zone calls for the kiss or deep kiss, the breast caress or nipple excitation, and the vulvar contacts. The third, or vaginal, zone may not become aroused until she has passed through the two preliminary phases of feeling. It is therefore essential that the man should understand the need for special attention to these zones, and specially to the clitoris and other parts of the vulva, during the early weeks and months, in order that adequate stimulation and complete climax may be effected.

*Orgasm.*—It is important also that the couple have clearly in mind the difference between excitement or passionate desire and climax or orgasm. There is in women no such dramatic evidence of the latter as in men, with whom the emission and subsidence of erection give proof of completion. She may also require two or three minor orgasms to his one, to discharge the battery, and to this possibility his attention should be drawn.

#### V. INSTRUCTION TO MAN AND WOMAN

1. *Coitus.*—Dr. Katherine B. Davis, in her study of one thousand American women, 87 per cent of whom reported themselves unequivocally happily married, finds a significant difference in the degree of marital happiness between couples who had been instructed before marriage and those who had not.<sup>2</sup>

*Frequency.*—As to frequency of coitus, the only rule is that developed by individual trial. One may state that, after the greater frequency of the first few weeks or months, the average is once or twice a week. The Davis<sup>2</sup> and Pearl<sup>3</sup> studies covering 1,600 couples agree that 10 per cent of the married desire coitus once a day or oftener, even after years of marriage, and there is a corresponding lower extreme. Somewhere along this scale is a cycle which conduces to happiness and health for the majority.

2. *Control of Conception.*—My habit has been to consider every couple at marriage entitled to full instruction concerning methods of birth control as part of the standard knowledge necessary for wholesome married life. I find few couples who marry without planning to have children, and I do not forget the strong argument put up by some of my friends in favor of giving such instruction only after the first child has been born: but I cannot see why the date of arrival of any child should be left to chance. The spacing of children alone is sufficient argument for informing patients concerning contraceptive methods. There were prohibitions by some older authorities against the marriage of persons who should not reproduce because of grave danger to mother and child, as in cases of chronic nephritis, or to the



community, as in cases of mental instability. But since birth control and sterilization have become effective, public opinion no longer condemns to celibacy men and women who can find happiness and spiritual development in marriage, even though childless.

Our chief concern in control of conception is to gain the maximum felicity and permanence for every day marriage. The main argument on this score is the wisdom of allowing for physical adjustments, such as settling into a new home, or the mental adjustments that must occur with every mating. No young wife should be subjected to the strains of pregnancy following immediately upon the exhausting process of wedding preparations and ceremony. Nor does it make for happy early adjustment to have the wedding trip or settling into a new home accompanied by the not infrequent nausea and irritability of early gestation.

I am yet to be convinced that there is any danger of sterility resulting from using contraceptive methods in the earlier months or years of marriage. In this connection, however, I warn the couple against the intrauterine stem and against leaving the vaginal occlusive pessary in for days or weeks at a time. I do not omit to warn couples whom I suspect may be selfish or may too long postpone the first child, of the danger of such a practice. I warn them also of the care necessary in early pregnancy lest abortion should occur.

#### SUMMARY

Based on a long series of patients' histories and decades of premarital instruction, this study considers preventable maladjustments, such as inhibitions that result in frigidity and details of anatomic findings that produce pain in coitus, and vaginismus. It urges the profession to develop systematic methods to forestall such troubles. Medical advice on major problems before engagements are announced, and complete examination before wedding days are fixed, should come through custom rather than by compulsory laws.

The clear-cut duty of the doctor is positive. His job is to forestall trouble, and to seek occasions for forestalling trouble.

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(For discussion, see page 721.)

## THE SURGICAL TREATMENT OF STERILITY WITH PARTICULAR REFERENCE TO SALPINGOSTOMY\*

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OF THE various causes of sterility in the female, which are amenable to surgical treatment, this paper will deal exclusively with tubal occlusion. In 1885, A. Martin, of Berlin, was the first to conceive the idea of incising the closed fimbriated end of the tubes and thereby make conception possible in an otherwise incurable condition. The operation never became popular, and reports of subsequent conceptions were published only very sporadically. When Gellhorn<sup>1</sup> presented the subject to this society in 1911 and reported a case of childbirth following salpingostomy, he could collect but thirteen other cases from the literature of the world.

At that time the attitude of American gynecologists toward plastic operations on the tubes was rather unresponsive, and J. G. Clark<sup>2</sup> probably voiced the general opinion when he stated that "conservative surgery has a very limited field. The only cases in which a salpingostomy is ever justifiable, is in old nonactive hydrosalpinx. The end-results of salpingostomies are disappointing. Pregnancy rarely takes place, as the newly formed ostia quickly becomes occluded and cause a recurrence of the symptoms."

More recently, however, interest in the operation has been revived as evidenced by a growing number of publications in the German, English, and French literature. This renaissance of salpingostomy is attributable, to a great extent, to the insufflation test of Rubin who has taught us that the large majority of tubal occlusions occurs at the fimbriated end. An attempt, then, at removing this obstruction by means of salpingostomy and restoring the blocked passage is, logically, the practical application of the test. The cure of sterility is one of the burning questions of the day, and the subject of salpingostomy and pregnancy is of such great importance that it seems justifiable to present it once more for consideration.

From 1904 to 1927 we performed the operation in fifty cases. With

\*Read by invitation, at a meeting of the American Gynecological Society, May 2, 1928.

the exception of the last few, we carried out salpingostomy only incidentally when, in the course of a laparotomy undertaken for other reasons, we found the tubes occluded. The primary indications were ectopic pregnancy, appendicitis, retroflexion, postoperative adhesions, old inflammatory processes, etc. In thirty-nine cases, one tube was removed at this time, or had been removed at some previous operation, and salpingostomy was performed on the remaining tube. A bilateral salpingostomy was done in eleven cases.

Of our fifty patients, we have been unable to trace twenty-two. Anyone familiar with conditions in large public hospitals appreciates the difficulties of keeping track of the floating population. The remaining twenty-eight patients, of whom we have records to date, belong largely to the private clientele of Dr. Gellhorn and myself; and I take this occasion to thank Dr. Gellhorn for the privilege of using his data.

Of these twenty-eight women, seven have conceived subsequently, which corresponds to 25 per cent. In comparing this percentage with the results recorded in literature, we find that Fuchs<sup>3</sup> and Ritter<sup>4</sup> obtained conceptions in 6 per cent, Unterberger<sup>5</sup> in 8.8 per cent, Seitz<sup>6</sup> in 9 per cent, and Solomons<sup>7</sup> in 39 per cent.

Our results are even more encouraging if the final outcome is considered. One patient had a repeated ectopic pregnancy in the reconstructed tube. Another first aborted and, later, gave birth to living twins. One woman had two living children, three had one child each, and one is, at present writing, in the fifth month of a normal pregnancy. This gives a total of seven living children with the probable addition of an eighth child, a result which, to my mind, fully justifies our efforts, for without them these women would never have enjoyed the happiness of motherhood. It is hardly necessary to point out that sterility is not merely a disappointment to the thwarted maternal instinct, but often a veritable disaster with very serious consequences, and that for this reason even a comparatively few successful cases constitute an important achievement.

Moreover, we rather confidently expect conception to occur in several of our patients who have been operated upon within the last year or two. Their tubes have remained open, as demonstrated by repeated Rubin tests; their objective and subjective conditions are excellent; and their husbands have healthy spermatozoa. There is, at times, a considerable interval between operation and conception. In one of our cases, it lasted seven years; and Isbruch<sup>8</sup> recorded a conception as many as fifteen years after salpingostomy.

Our cases, then, and those of other operators have refuted the former pessimism toward the value of salpingostomy. It has, however, been argued that even when this operation is followed by conception, the pregnancy is likely to be abnormal; this refers in particular to a

number of abortions and repeated ectopic pregnancies recorded in literature. Our own material does not bear out these criticisms. Only one of our patients aborted, but later gave birth to healthy children. Where, in the available statistics, the frequency of abortion was conspicuous, we may well assume that the same inflammatory cause which had led to an occlusion of the tube, was still operative in the endometrium and prevented the undisturbed growth of the ovum. The abortion, therefore, cannot be laid at the door of the operation, but must be ascribed to failure of treating the underlying etiology in both uterus and tubes, in other words, to a fault in technic which will be discussed later.

Richard R. Smith, years ago, showed in this society that there is a tendency for an ectopic gestation to reoccur in the other tube. We had one such case in our series, and Wesenberg,<sup>9</sup> Paucot,<sup>10</sup> and others have made similar observations. But such a repetition of ectopic pregnancy is, after all, only a possibility, not a probability; and if one operated on a young childless woman for an ectopic, and found the other tube closed, one would surely give her the benefit of the doubt and reopen this tube. We did this in one of our cases, and the patient later went through a normal pregnancy. Gellhorn<sup>1</sup> considers salpingostomy particularly promising when operating on the other tube for ectopic gestation, and his views are shared by Rosenstein,<sup>11</sup> Kehrer,<sup>12</sup> Mayer,<sup>13</sup> Asch<sup>14</sup> and others.

We are now confronted with this situation. Tubal occlusion is an absolute bar to conception. Salpingostomy is positively the only means of overcoming this obstacle. Conception, however, occurs only in a small percentage of the cases. What can we do to improve our results?

The answer to this question includes two factors; namely, first the proper selection of cases; second, an appropriate technic.

The proper selection of cases demands careful preoperative study and rests on the following points:

1. The husband must be found in perfect condition for procreation. This self-evident premise was frequently overlooked as long as salpingostomies were performed only secondarily in the course of a laparotomy.

2. The patient herself should be at an age favorable for conception and childbearing, preferably not beyond thirty-five years. Two of our patients were thirty-eight and forty-two years old, respectively, and their ages may have been responsible for the failure of the operations.

3. Cases of infantilism or of other dysfunction of the ductless glands should be excluded, because we know that in these, conception is not likely to occur.

4. Cases of acute inflammation of the tubes whether of gonorrheal, postabortal or puerperal origin, are unsuited for the operation. Prochownik<sup>15</sup> opened the occluded tubes in six cases of very acute salpingitis and, strangely enough, obtained success in two of them. Quite recently, Bourne<sup>16</sup> reported seventeen cases of salpingostomy for acute salpingitis without subsequent pregnancies. All other writers consider operations in the acute stage as useless and dangerous.

5. Of the chronic infections, tuberculosis of the tubes should be treated by radical removal. In other chronic inflammatory conditions salpingostomy should be performed only after careful preoperative preparation as will be discussed under the head of technic.

6. The most favorable results will be obtained in cases where the occlusion has been produced by factors outside of the tubes, such as appendicitis and ectopic pregnancy.

7. Salpingostomy is, further, indicated in cases of hydrosalpinx of moderate extent if the walls of the tube are still fairly thick, and of hematosalpinx of obscure origin.

The question of technic is of paramount importance. Salpingostomy has absolutely no mortality, and hardly ever have any other ill effects due to the operation itself been noted which have rendered a second operation necessary. Even though the procedure is practically harmless, yet we should approach it only with due caution. The following points demand consideration:

1. Having ascertained by means of the Rubin test that the tubes are occluded, we may inject iodized oil to determine the exact site of the occlusion. This oil has probably no ill effect upon the tubal mucosa, but if during the subsequent salpingostomy some of it runs out, the peritoneum, which is highly sensitive, may be irritated. We have positive proof of this in one case, and Fraenkel<sup>17</sup> recently expressed himself in a similar manner. We, therefore, abstain from the preliminary injection of oil.

2. At the laparotomy, the tube is lifted out of the wound and held with the hand, but not with an instrument. The occlusion is one of two types. In the first type, the fimbriae are invaginated into the lumen of the tube, sucked in, as it were, and held by a constriction of the serosa. This constriction should be stretched gently and bluntly, perhaps with the handle of the knife or the closed Mayo scissors, thus enabling the imprisoned fimbriae to slip outward. In the second type, where all signs of the fimbriae are obliterated, a longitudinal incision of 2 cm. is made into the lumen, the flaps are everted and fastened with four interrupted sutures of catgut No. 00, twenty days, to the serosa of the tube. All bleeding points are ligated with plain catgut No. 00, and great care is taken not to produce any fresh bleeding in sewing on the flaps. Two or three strands of thin catgut are pushed into the lumen of the tube; these strands are about 6 cm. (2 inches) long, and their ends protrude about one half inch out of the newly formed opening. I was pleased to find that Solomons<sup>7</sup> who seems to have obtained the largest number of successes, uses the same method and ascribes to it his results. Finally, the ovary is brought closer to the outer end of the tube by an approximating suture.

3. After the incision into the tube but before stitching the flaps in place, the patency of the uterine part of the tube should be ascertained by means of

air inflation as advocated by Curtis<sup>18</sup>. For this I use a soft rubber ear syringe which fits snugly into the lumen of the tube. Failure to force air through the tube into the uterus does not necessarily mean occlusion at the isthmus. The passage may be closed only temporarily due to congestion of the mucosa, for in one of our cases where this test failed at operation, the patient conceived two years later.

4. In every case, the patency of the new ostium is tested by the Rubin insufflation after operation; the first test is made two weeks after the operation when the patient leaves the hospital, and it is repeated two or three times at bi-weekly or monthly intervals; and if there have been slight elevations of temperatures not readily explained by other causes, dry heat or diathermy are employed systematically during the immediate convalescence.

5. Particular attention is given to preoperative preparation whenever there is a history of findings of a previous inflammation. In such cases all methods of conservative treatment are called into use, such as protein therapy, dry heat, diathermy, protracted hot douches, etc. The persistence of any infectious process is determined by the sedimentation test; and only if after sufficient time, all clinical signs and laboratory tests indicate the disappearance of the infection, is the operation undertaken.

I am very conscious of the fact that salpingostomy which demands such painstaking preparation and such minute refinement of technic has, after all, only a limited field, but within this restricted sphere there is no other remedial measure available, and the good that may come from it is so satisfying and contributes so much to human happiness, that it deserves the consideration and, I hope, the approval of this Society.

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LISTER BUILDING.

(For discussion, see page 735.)

# IMMEDIATE AND REMOTE RESULTS IN TWO HUNDRED TWELVE CASES OF PROLAPSE OF THE UTERUS\*

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THE gynecologist confronted with the problem of curing a patient afflicted with prolapse of the uterus is influenced by three factors in his choice of operation: first, by the limitations and conditions in the given patient; second, by his familiarity and previous success with particular types of operations; and third, by his desire to improve his results through the utilization of other methods. With this in mind it seemed desirable to analyze the results obtained in the gynecologic department of the Michael Reese Hospital. There is abundant literature on the subject of prolapse of the uterus, but there are not many articles dealing with comparative results of different operations from individual clinics. Among the best of these studies are those by Bul-<sup>1</sup>lard who analyzed the work of The Woman's Hospital of New York City, Clark<sup>2</sup> of Philadelphia, and Spalding<sup>4</sup> of San Francisco.

Our paper deals with the last 220 consecutive operations for the relief of prolapse of the uterus in 212 patients. A survey of the ages of these patients gives a range of 24 years to 79 years with an average age of 45.8 years. This average is practically identical with the figures given in the literature. An analysis of the figures by decades reveals the fact that while the greatest number of patients applies for relief in the 40-50 or menopausal decade and the second largest number is found in the 30-40 group, the third largest occurred in the 60-70 group. Apparently if patients do not need relief at or before the menopause, they remain free from symptoms until senile atrophy affects the tissues.

AGE INCIDENCE		
<i>Youngest—24</i>	<i>Oldest—79</i>	<i>Average—45.8</i>
Under 30		12
30-40		55
40-50		80
50-60		26
60-70		33
70 and over		6

The patients in this series bore a total of 892 children, an average parity of 4.2. They range from five nulliparae to one para xiv. One hundred and twelve patients, over one-half the total, are found in the para ii, para iii, and para iv groups.

PARITY INCIDENCE			
Nulliparae	5	Para viii	9
Primiparae	16	Para ix	4
Para ii	39	Para x	5
Para iii	44	Para xi	2
Para iv	29	Para xii	3
Para v	25	Para xiii	1
Para vi	21	Para xiv	1
Para vii	8	Average parity	4.2

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While it would seem from these figures that the frequency of prolapse is not proportional to the frequency of childbirth, this series is not large enough to justify such a conclusion. Moreover, it must be borne in mind that family limitation plays a rôle in decreasing the number of women who have more than four children.

Among the 220 operations in 212 patients, sterilization was done 102 times (46.8 per cent). In 3 patients (1.3 per cent) there had been previous sterilization. Eighty-eight operations (40 per cent) were

## STERILIZATION

Sterilized	101,	46.0 per cent
Sterilized previously	3,	1.3 per cent
Postmenopausal	88,	40.0 per cent
Menopausal	12,	5.4 per cent
Conserved	10,	4.6 per cent
Diabetic	2,	0.9 per cent
Incomplete operation	2,	0.9 per cent
Forgotten	2,	0.9 per cent

performed on women who had already passed the menopause. Twelve patients (5.4 per cent) were in the menopause at the time of operation. Two patients (0.9 per cent) were diabetic and though still menstruating were operated for the relief of symptoms without the risk of prolongation incurred by sterilization. In two patients (0.9 per cent) the operative procedure had to be terminated without sterilization because of shock. In twelve patients (5.4 per cent) childbearing was deliberately conserved. These were young women in whom only suspension operations with vaginal plastics or plastics alone were done. One of these subsequently became pregnant and following delivery there was a recurrence of the prolapse. This patient was sterilized at a secondary operation for prolapse. In two, sterilization was forgotten. One was sterilized by deep x-ray therapy before leaving the hospital; the second became pregnant and was delivered by section, at which time she was sterilized.

*Symptoms.*—Protrusion was the outstanding complaint 129 times (58.6 per cent). In 118 patients (53.6 per cent) discomfort predominated in the form of lower abdominal pain 40 times (18.1 per cent),

## SYMPTOMS

Protrusion	129,	58.6 per cent
Discomfort	118,	53.6 per cent
Abd. pain	40,	18.1 per cent
Backache	62,	28.1 per cent
Bearing down	38,	17.3 per cent
Bladder Distress	74,	33.6 per cent
Frequency	66,	30.0 per cent
Dysuria	29,	13.1 per cent
Incontinence	12,	5.4 per cent
Constipation	58,	26.3 per cent
Leucorrhea	19,	8.6 per cent
Dysmenorrhea	7,	5.3 per cent
Menorrhagia	10,	7.6 per cent
Metrorrhagia	10,	4.5 per cent



backache 62 times (28.1 per cent), and bearing down 38 times (17.3 per cent). In 74 patients (33.6 per cent) who had bladder distress, frequency occurred 66 times (30 per cent), dysuria 29 times (13.1 per cent), and incontinence 12 times (5.4 per cent). Constipation was noted in 58 patients (26.3 per cent). Leucorrhœa was a complaint in 19 patients (8.6 per cent). Dysmenorrhœa was present in 7 instances and menorrhagia in 10; the percentage frequencies, omitting the menopausal group, were 5.3 per cent and 7.6 per cent respectively. Metrorrhagia occurred 10 times (4.5 per cent) in the entire group.

*Pathology.*—First degree prolapse was found in 25 patients (11.4 per cent), second degree prolapse in 73 patients (33.2 per cent), and third degree prolapse in 122 patients (55.4 per cent). For purposes of comparison a standardized classification of prolapse is essential. As previously noted<sup>3</sup> this does not exist in the current literature, American or foreign. Action aimed at the clarification of this situation would definitely enhance the value of statistical comparisons in this field. In this paper first degree prolapse is defined as a descent of the uterus in which the cervix reaches the ischial spines; second degree prolapse as a descent of the uterus in which the cervix appears at the vulva, and third degree prolapse as a protrusion of the cervix or corpus uteri through the vulva.

#### PATHOLOGY

Prolapse		
First degree	25,	11.4 per cent
Second degree	73,	33.2 per cent
Third degree	122,	55.4 per cent
Cystocele and rectocele	162,	73.6 per cent
Rectocele only	21,	9.5 per cent
Fibroids	20,	9.0 per cent
Fibrosis uteri	6,	2.7 per cent
Cervix	54,	24.5 per cent
Hypertrophy and laceration	44,	20.0 per cent
Erosions	7,	3.2 per cent
Polyp	3,	1.3 per cent
Miscellaneous		
Ovarian cyst	5	
Ovarian fibroid	1	
Hemorrhoids	5	
Appendicitis	6	
Diabetes	6	
Myocarditis	6	
Marked hypertension	3	
Cystopyelitis	1	
Salpingitis	1	
Tuberculosis abd.	1	
Deep Douglas	3	

There were 162 instances of cystocele and rectocele (73.6 per cent) and 21 (9.5 per cent) of rectocele without cystocele. Fibroids were present in 20 patients (9 per cent) and fibrosis uteri in 6 (2.7 per cent). Pathology of the cervix was found in 54 women (24.5 per cent). Of these, 44 (20 per cent) had hypertrophy or laceration, 7 (3.2 per cent) had cervical ulcerations and 3 (1.3 per cent) cervical polyps. The

remaining associated pathology comprised 5 ovarian cysts, 1 ovarian fibroid, 5 instances of hemorrhoids, 6 of appendicitis, 6 diabetics, 6 with myocarditis, 3 with marked hypertension and one each of cystopyelitis, salpingitis, Bartholin cyst, and pelvic tuberculosis. In three patients the operator diagnosed congenitally deep Douglas. If the deep Douglas is a predisposing factor in the development of prolapse of the uterus, the number noted here would seem too small. Either many instances of deep Douglas were overlooked or its significance has been overestimated.

*Previous Operations.*—Of the 212 patients whose records form the basis of this analysis, 30 had been operated previously for prolapse, 2 of them being operated three times each, a total of thirty-two reoperations. In only 8 instances, however, did the reoperations fall in the period covered by this study. The remaining twenty-four primary operations were done in other institutions or prior to the beginning of this series. It is of interest to note the methods chosen in the presence of a previous failure. There were 9 interposition operations, 6 LeFort vaginal occlusions, 5 Ries fixations, 5 ventrofixations, 4 Murphy extrafascial fixations, and one each ventrosuspension, vaginal hysterectomy and supravaginal hysterectomy with stump fixation. Whether the best surgical treatment for prolapse of the uterus is achieved by the utilization of the uterus or by the sacrifice of the uterus together with fascial reconstruction is still an open debate in the world's literature. In the reoperative procedures just listed, there were only two instances of the removal of the uterus, evidence that preservation of the uterus is considered essential by the gynecologic staff at the Michael Reese Hospital.

*Operative Procedures.*—The 220 operations were apportioned as follows—91 Watkins interpositions, 28 Ries fixations, 27 ventrofixations, 17 vaginal plastics, 14 Le Fort vaginal occlusions, 14 ventrosuspensions, 13 Murphy extrafascial fixations, 7 vaginal hysterectomies, 5 supravaginal hysterectomies, 2 cervical stump fixations, and 2 Kielland-Wertheim interpositions.

#### OPERATIVE PROCEDURES

Watkins interposition	91
Ries abdominal fixations	28
Ventrofixations	27
Vaginal plastics	17
LeFort vaginal occlusions	14
Ventrosuspensions	14
Murphy extrafascial fixations	13
Mayo vaginal hysterectomy	7
Supravaginal hysterectomy	5
Cervical stump fixations	2
Kielland-Wertheim interpositions	2

Mouth temperatures of 101° F. were considered morbidity in calculating gross morbidity. Corrected morbidity figures were based on

the presence of recognizable pathology and exclusive of fever without localized pathology.

*Interposition.*—There were 91 Watkins interposition operations (41 per cent). There was one death (1.1 per cent) in this group. The patient was a sixty-five-year-old para-v with a third degree prolapse and a systolic blood pressure of 164 n. Convalescence was uneventful. On the eighth day the patient suddenly died. Death was apparently due to cerebral embolism, but no autopsy was obtained. The gross morbidity was 55.1 per cent. The corrected morbidity was 12.1 per cent due to infection of the operative field in eleven patients, in one of whom there was a generalized sepsis with recovery. The group of interposition operations summarized here has been reported in detail elsewhere.<sup>3</sup> Thirty-nine patients (43 per cent) required catheterization from one to nineteen days. The average hospital stay was 17.2 days.

*Ries Fixation.*—There were 28 repairs by the Ries fixation method.<sup>3</sup> There was one death. The patient was a forty-six-year-old para vi with a third degree prolapse. She died twenty-four hours after operation from hemorrhage and shock. There was a gross morbidity of 35.7 per cent and a corrected morbidity of 10.7 per cent. This latter represents four patients. In one there was a wound infection, in a second, wound infection and gastric dilatation, in the third there was an acute gastric dilatation, and in the fourth there was a bronchopneumonia. Six patients were catheterized for from one to three days, an incidence of 21.4 per cent. The average hospital stay was 22.2 days.

#### OPERATIVE RESULTS

OPERATIONS	NO.	DEATHS	GROSS MORBIDITY (PER CENT)	CORRECTED MORBIDITY (PER CENT)	CATHETERIZ. (PER CENT)	AVERAGE HOSP. STAY
Interposition	91	1	55.1	12.1	43.0	17.2
Ries fixation	28	1	35.7	10.7	21.4	22.2
Ventrofixation	27	0	44.4	26.0	15.3	21.3
Vaginal plastic	17	0	11.8	11.8	23.5	19.4
Vaginal occlusion	14	0	21.7	7.3	7.3	17.3
Ventrosuspension	14	0	57.1	35.7	21.4	18.4
Extrafascial fixation	13	0	46.0	7.8	23.0	18.7
Vaginal hysterectomy	7	1	43.0	28.6	28.6	19.0
Supravag. hysterectomy	5	0	60.0	20.0	40.0	16.8
Cervical stump fixation	2	0	0			
Kielland interposition	2	1	0			
Total + Averages	220	4—(1.8%)	44.5	15.4	29.5	18.8 days

*Ventrofixation.*—Twenty-seven patients were operated upon by ventrofixation and vaginal plastics. There was no mortality, a gross morbidity of 44.4 per cent and a corrected morbidity of 26 per cent. There were two abdominal wound infections, three vaginal infections, one rectovaginal fistula, and one instance of shock. Four patients re-

quired catheterization from three to eight days, an incidence of 15.3 per cent, and the average hospital stay in this group was 21.3 days.

*Vaginal Plastic.*—Vaginal plastic alone was resorted to 17 times, including 7 cervical amputations. There were no deaths. Two patients (11.8 per cent) carried a morbidity. In one this was due to hemorrhage with repeated vaginal packing, perineal infection, pyelitis, resuture, and eventual complete healing. In the other there was hemorrhage, infection and cystitis with a satisfactory outcome. Four patients were catheterized from one to eleven days (23.5 per cent). The average hospital stay was 19.4 days.

*LeFort Vaginal Occlusion.*—The LeFort vaginal occlusion was done 14 times, without mortality and a gross morbidity of 21.7 per cent. There were two instances of fever and one of postoperative cystitis, a corrected morbidity of 7.3 per cent. Catheterization was necessary in only one patient (7.3 per cent) and the average hospital stay was 17.3 days.

*Ventrosuspension.*—Of 14 patients, 13 were of the Gilliam type. A vaginal plastic was done in each instance. There was no mortality and the gross morbidity was 57.1 per cent. The corrected morbidity was 35.7 per cent and included two wound infections, with a three-day partial ileus in one, an acute gastric dilatation, a parotid abscess and a postoperative hemorrhage. This occurred on the tenth day. Catheterization was necessary in 3 instances, 21.4 per cent, and the average hospital stay was 18.4 days.

*Extrafascial Fixation.*—The Murphy extrafascial fixation operation was employed thirteen times without mortality. The gross morbidity was 46 per cent; the corrected morbidity was 7.8 per cent. This was due to an acute gastric dilatation. It was necessary to catheterize three patients from three to seven days, 23 per cent. The average hospital stay was 18.7 days.

*Vaginal Hysterectomy.*—Among the seven Mayo vaginal hysterectomies there was one death. This was a forty-one-year-old para v with multiple fibroids, a third degree prolapse, and a systolic blood pressure of 220 millimeters. This patient died in twelve hours of acute cardiac dilatation and shock. The gross morbidity figure was 43 per cent and the corrected morbidity was 28.6 per cent, based on one patient who developed parotid abscess and one who developed a postoperative pyelitis. Two patients were catheterized, 28.6 per cent, and the average hospital stay was 19 days.

*Supravaginal Hysterectomy.*—Supravaginal hysterectomy was done five times without mortality. Three patients had fever and one developed a foul discharge—morbidity of 60 per cent and 20 per cent respectively. Two required catheterization and the average hospital stay was 16.8 days.

*Cervical Stump Fixation.*—This was done only twice, each patient registering 101° F. once. One required a single catheterization and the hospital stay was 16 days.

*Kielland Interposition.*—Of the two patients in whom the Kielland-Wertheim interposition operation was performed, one, a sixty-year-old para vii with a third degree prolapse, died of a lobar pneumonia on the eighth day. The other made an uneventful recovery.

#### REMOTE RESULTS

The end-results in this series were determined by examination in every instance. These examinations were made either by the operator himself or by some other member of the gynecologic staff. All patients were examined for immediate and remote results. Only the records of those women who were reexamined four months or more after operation are included in this analysis of remote results. Of the 220 operations in 212 patients, four resulted in death (1.8 per cent). Of the remaining 216, remote results were obtained in 148 (69 per cent). One hundred twenty-seven (85.8 per cent) were successful, 9 (6.1 per cent) were partially successful, and 12 (8.1 per cent) were failures. The operative end-result was considered only partially successful if a third degree prolapse recurred as a first degree prolapse or if a cystocele or rectocele recurred. Combining the improved and the cured groups, 136 (91.9 per cent) were successful.

*Watkins Interposition.*—In sixty-four patients in whom the interposition operation was done, the outcome was completely successful in 56 (87.5 per cent), partially successful in three (4.7 per cent), and a failure in five (7.8 per cent). Of these failures there was infection present in two. The remaining three had an uneventful convalescence.

*Ries Fixation.*—Of 15 patients operated by the Ries fixation method, 12 (80 per cent) were successful, one (6.7 per cent) was partially successful, and two (13.3 per cent) were failures. Of these failures, one was due to infection followed by severe hemorrhage on the twenty-fourth day and the other resulted from wound infection and bronchitis.

*Murphy Fixation.*—There were twelve Murphy extrafascial fixations, all of which (100 per cent) were successful.

*LeFort Operation.*—There were ten LeFort vaginal occlusion operations, all of which (100 per cent) were successful.

*Ventrosuspension.*—Of eleven Gilliam ventrosuspension operations, ten (91 per cent) were successful and one (9 per cent) was a failure. This patient, a thirty-two-year-old para iv with second degree prolapse, declined sterilization, became pregnant, and following delivery had a recurrence of the prolapse.

*Ventrofixation.*—Of 19 ventrofixations, 18 (94.7 per cent) were successful and one was a failure (5.3 per cent). This was a thirty-year-

<i>Type Operation</i>	<i>Success (Per Cent)</i>	<i>Partial Success (Per Cent)</i>	<i>Failure (Per Cent)</i>
Entire series	85.8	6.1	8.1
Watkins interposition	87.5	4.7	7.8
Ries fixation	80.0	6.7	13.3
Murphy fixation	100.0		
LeFort occlusion	100.0		
Ventrosuspension	91.0	0.0	9.0
Ventrofixation	94.7		5.3
Supravaginal hysterectomy	75.0		25.0
Vaginal plastic	45.0	36.0	19.0
Vaginal hysterectomy	100.0		
Total	85.8	6.1	8.1

old nullipara with a third degree prolapse complicated by a pelvic and abdominal tuberculosis. A bilateral salpingo-oöphorectomy was done together with a ventrofixation. Three months later the prolapse recurred completely. The record of this patient reappears as a failure in the next series.

*Supravaginal Hysterectomy.*—Supravaginal hysterectomy was done four times. In three instances there was complete success (75 per cent). The fourth, a failure, was the patient with tuberculosis listed as a failure after ventrofixation.

*Vaginal Plastic.*—Of the eleven patients treated by vaginal plastics, cervical amputation was included in four. Five were successful, four partially successful, and two were failures. Of these failures, one was a thirty-nine-year-old para iv with a second degree prolapse who made an uneventful recovery, and left the hospital of her own accord on the eleventh day. Three years later she returned with a second degree prolapse, was operated by ventrofixation and was cured. The second an uneventful recovery with a fourteen day convalescence. Six months later she returned with a second degree prolapse and a bladder stone. was a forty-four-year-old para iv with a first degree prolapse who had An interposition operation was done and after three months this was likewise a failure.

*Vaginal Hysterectomy.*—There were five vaginal hysterectomies, all successful.

*Stump Fixation.*—There were two cervical stump fixations, one a success and one a failure.

*Kielland.*—There was one Kielland-Wertheim interposition which was a success.

*Residual Complaints.*—Comparatively few patients in the series had residual complaints. There were five with leucorrhœa, three with post-operative cystitis, two with frequency, one with incontinence, two with backache, and one with bearing down. Three developed incisional hernias, one a rectovaginal fistula, and one patient on whom a supravaginal hysterectomy had been performed developed a carcinoma of the cervical stump for which she is now receiving radium treatment.

## SEQUELAE

<i>Complaints</i>		<i>Findings</i>	
Leucorrhœa	5	Incisional hernia	3
P.O. cystitis	3	Rectovag. Fistula	1
Frequency	2	Carcinoma in cerv. stump	1
Incontinence	1		
Backache	2		
Bearing down	1		

*Choice of Operation.*—A comparative study of the end-results obtained in this series would seem to indicate that a ventrosuspension of the uterus together with a vaginal reconstruction affords the best type of relief in those patients with prolapse in whom childbearing is to be conserved.

The interposition operation is "the operation of choice at the Michael Reese Hospital in 41 per cent of patients with prolapse. It is selected for those patients with a large cystocele, a corpus uteri neither too large nor too small, freely movable and without gross adnexal pathology."<sup>3</sup>

For older women in whom the uterus is atrophic the Murphy extrafascial fixation operation is preferable when the abdominal wall is competent, and when the patient's condition demands a short operative procedure.

The LeFort vaginal occlusion operation should be limited to older women with atrophy of the cervix and with senile atony of the anterior and posterior fascial and muscular structures, and in whom marital relations have terminated.

The value of the Mayo vaginal hysterectomy for the cure of prolapse of the uterus cannot be discussed further than to point out that preservation of the uterus and its utilization has seemed fundamental to the gynecologic department of the Michael Reese Hospital. The results presented here apparently justify a continuation of those types of operation in use at present.

## SUMMARY

In 220 operations for prolapse of the uterus in 212 patients, the average age was 45.8 years, the average parity 4.2, 192 patients (87.3 per cent) were postmenopausal or were sterilized. Twenty-five (11.4 per cent) were first degree prolapse, 73 (33.2 per cent) were second degree prolapse, and 122 (55.4 per cent) were third degree prolapse.

Eleven types of operations were employed. Based on the immediate and remote results, four of these seem best suited to meet particular indications, namely, Gilliam suspension with vaginal reconstruction, the Watkins interposition operation, the Murphy extrafascial fixation operation, and the LeFort vaginal occlusion operation.

There were four deaths (1.8 per cent). One was from cardiac dilatation and shock, one from lobar pneumonia, one from cerebral embolism and one from hemorrhage and shock.

End-results by personal examination were obtained after 148 operations (69 per cent). One hundred twenty-seven (85.8 per cent) were successful, 9 (6.1 per cent) were partially successful and 12 (8.1 per cent) were failures. Combining the cured and improved groups, 136 (91.9 per cent) were successful.

Acknowledgment is hereby made to the members of the gynecologic staff of the Michael Reese Hospital for the use of their records.

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104 SOUTH MICHIGAN AVENUE.

(For discussion, see page 727.)

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### CLINICAL RESULTS OBTAINED WITH OXYTOCIN AND VASOPRESSIN, THE RECENTLY ISOLATED PRINCIPLES OF PITUITARY EXTRACT\*

BY GEORGE GRAY WARD, M.D., EDWARD C. LYON, JR., M.D., AND  
GEORGE G. BEMIS, M.D., NEW YORK, N. Y.

THE pituitary gland is remarkable in containing two anatomic divisions that differ materially in their importance to life and their pharmacologic activity. It is also extraordinary that the posterior lobe, which is not so essential to life, contains a hormone or hormones which can produce at least three definite physiologic activities, namely, the effect to stimulate uterine contractions (oxytocic action), the ability to raise the blood pressure (pressor action), and its marked diuretic-antidiuretic effect (renal action).

These actions of the posterior lobe of the pituitary gland are of course well known and widely made use of in stimulating nonstriated muscle to contract as in atonic uterine conditions, intestinal paresis, and vesical atony, to raise lowered blood pressure as in shock, and in the treatment of diabetes insipidus. Chemical information, however, concerning these various physiologic activities is not so well understood and it has been a subject of controversy among biologic chemists as to whether these actions are due to one substance or several different compounds.

American investigators have generally favored the idea of a single hormone. Abel and his collaborators reached such a conclusion in 1923. The English workers, however, have advocated the multiple principle theory and the Germans have claimed the separation of

\*Read at the Fifty-third annual meeting of the American Gynecological Society, held in Washington, D. C., April 30-May 2, 1928.



three or more. Very recently Kamm, working with his collaborators, Aldrich, Grote, Rowe, and Bugbee, has published an important study in which they have succeeded in completely separating two active principles with distinct physiologic effects. One of these is oxytocic in its action without blood pressure raising effect, and the other is pressor in action raising blood pressure, but without effect in producing contractions in nonstriated muscle fiber. Furthermore, they have been able to recombine these two fractions in the original proportions and have secured a pituitary solution indistinguishable from the original pituitary extract. These two separated principles have been obtained in highly potent form and have been designated as oxytocin and vasopressin.

There is at present only one official standard for posterior lobe extracts of the pituitary gland. This is based upon the oxytocic test of the U. S. Pharmacopoeia. The amount of activity contained in 1 c.c. of the extract has been designated as "10 international units."

It is apparent that in view of the separation of the pressor from the oxytocic principle there should be a pressor standard as well as an oxytocic standard. Kamm has found that there is a fairly constant relation between the amounts of oxytocic and pressor activities in the pituitary extract, and they have provisionally designated the amount of pressor activity in 1 c.c. of the official extract as "10 pressor units." Ordinary pituitary extract as prepared for obstetric use, therefore, contains 10 oxytocic units and 10 pressor units per cubic centimeter, while the pituitary extract for surgical use has twice this strength.

The two separated principles of oxytocin and vasopressin have been obtained as highly potent water soluble powders. The oxytocin assays 12 units of oxytocic activity per cubic centimeter while its pressor activity is considerably less than 1 unit per cubic centimeter. This, therefore, meets fully the U.S.P. potency requirements, yet it is practically devoid of the characteristic blood pressure raising principle of posterior lobe extracts.

The vasopressin has been prepared so that the assay demonstrates that it contains 25 pressor units per cubic centimeter, but when assayed by the oxytocic method, it is found to contain only 1 unit of oxytocic activity.

The research of these investigators indicates that the pressor principle is responsible for the diuretic-antidiuretic action of pituitary extracts. A detailed study of the physiologic effects of these two hormones has not as yet been completed, but as the same two products in admixture are in daily use as pituitary extract, the clinical application can be made with safety.

The clinical application of oxytocin would naturally be suggested for those obstetric cases where it would be detrimental to increase a blood pressure which was already too high, yet where oxytocic results

were indicated as, for instance, in eclampsia or toxemia. It has been our custom at the Woman's Hospital to avoid giving pituitary extract in such cases.

Chipman has stated that the use of pituitary extracts in preeclamptic women precipitated convulsions and that their use was absolutely contraindicated in these toxic cases, in that it produces capillary spasm which increases both the frequency and the severity of the convulsions. If this observation is correct, it is presumably due to the vasomotor fraction, and it would be a natural expectancy that the oxytocic principle alone would not induce it.

It is evident that it is essential to establish clinically that oxytocin alone will accomplish the characteristic effects of pituitary extract when employed for obstetric purposes. To determine this point we have made a series of observations of the effect of oxytocin on the uterus, and a like series with pituitary extract as a control. Fifty cases were studied with oxytocin and 50 cases with pituitrin. The type of case employed for these tests included spontaneous, forceps, and breech deliveries. A routine technic was adopted of injecting two ampules after the birth of the baby and two ampules after the delivery of the placenta. A small number of cases had but one ampule at each injection, but it was found necessary to increase the dose in order to obtain results sufficiently positive to enable accurate observations to be made. The observations were made on the amount of blood loss and on the behavior of the uterus.

TABLE I. BLOOD LOSS (ESTIMATED)

	PITUITRIN	OXYTOCIN
Slight Bleeding (Under 100 c.c.)	14	21
Moderate Bleeding (100-300 c.c.)	33	28
Marked Bleeding (300-500 c.c.)	3	1
Excessive Bleeding (500 c.c. or over—first degree hemorrhage)	0	0
Total Cases	50	50

TABLE II. CONTRACTION OF UTERUS

	PITUITRIN	OXYTOCIN
Strongly Contracted	38	43
Moderately Contracted	9	6
Relaxed	3	1
Total Cases	50	50

The accompanying tables show the result of this study: Table I shows the estimated blood loss in the 100 cases studied with the two products. The cases were grouped under the four headings of slight (under 100 c.c.), moderate (100-300 c.c.), marked (300-500), and excessive (500 c.c. or over, 1 hemorrhage) postpartum blood loss. It will be noted that there was no case with excessive blood loss with either product.

Table II shows the effect of these agents on the contraction of the uterus in the same series. The cases were classified in accordance with their response as strongly contracted, moderately contracted, and relaxed.

A study of these tables shows that while there was no *marked* difference in blood loss or the contraction of the uterus with either oxy-

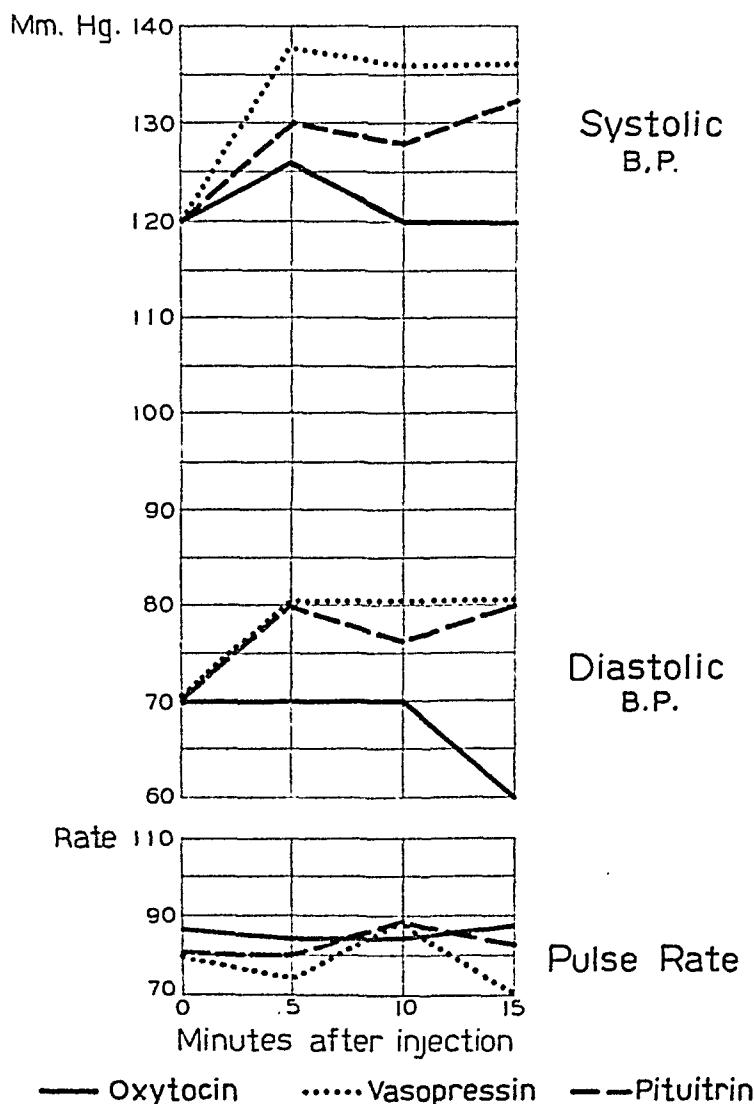


FIG. 1.—Graph showing effect of the hypodermic administration of one ampoule doses of oxytocin, vasopressin and pituitrin in a selected case.

tocin or pituitrin, there was a *slight* difference in favor of oxytocin. There would seem to be no doubt whatever that in this series oxytocin had an equally potent oxytocic action as the standard pituitary extract. Having established this fact, we next attempted to make a comparative study of the effect on blood pressure and the pulse rate of the oxytocin, vasopressin, and pituitrin.

Our first series consisted of 48 cases observed with a one cubic

centimeter dosage of the three products. Systolic and diastolic blood pressure readings were made before and five, ten, and fifteen minutes after administration.

The graphs in Figs. 1 and 2 show typical examples of the response to the substances. In Fig. 1 it will be noted that vasopressin raised the blood pressure in five minutes 17 points systolic and 10 points dias-

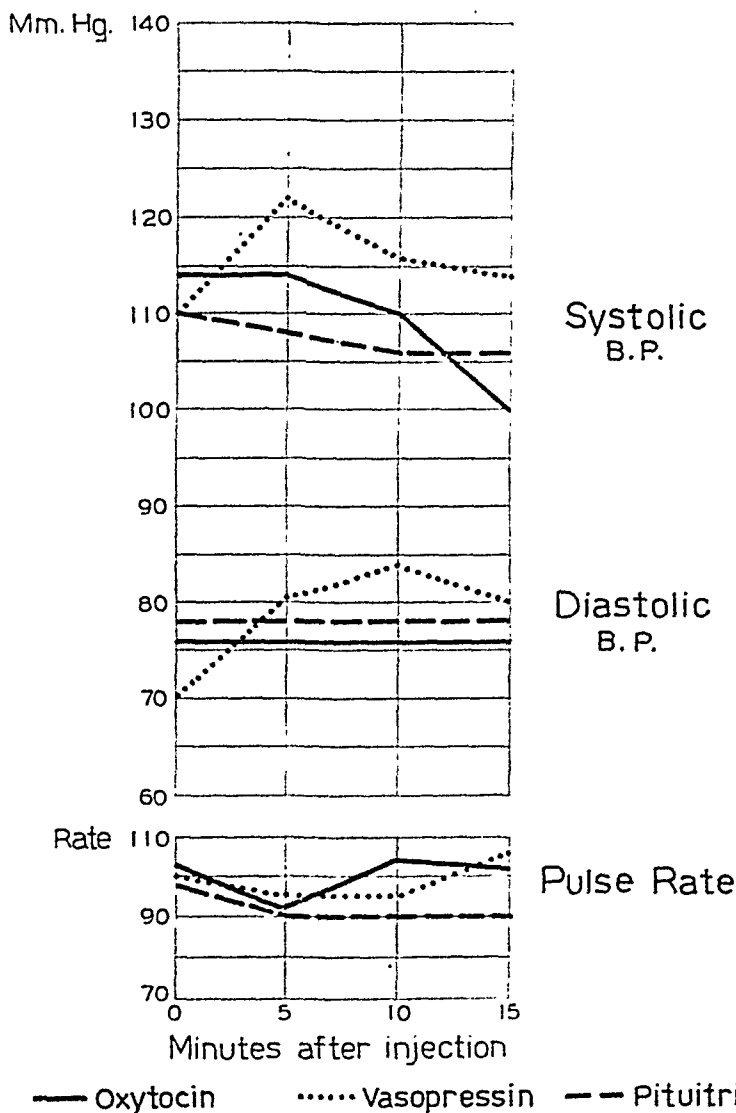


Fig. 2.—The same with two ampoule dosage in a selected case.

tolie, and pituitrin in the same time 10 points systolic and diastolic. which pressures were maintained during the fifteen minute period of observation, while the oxytocin showed at the end of five minutes an increase of only 5 points with immediate drop to normal.

The pulse rate showed a slightly lower average rate with vasopressin and pituitrin than with oxytocin as would be expected, owing to the increased resistance to the blood stream as a result of the higher blood pressure. Fig. 2 gives a similar demonstration.

Fig. 3 shows the average readings of the first series of 48 cases. As will be observed the variations were not marked although they show the same relative differences. We therefore made a second series of 12 cases with an increased dosage of 2 c.c. which demonstrated more positively the differences between the products, as shown in Fig. 4.

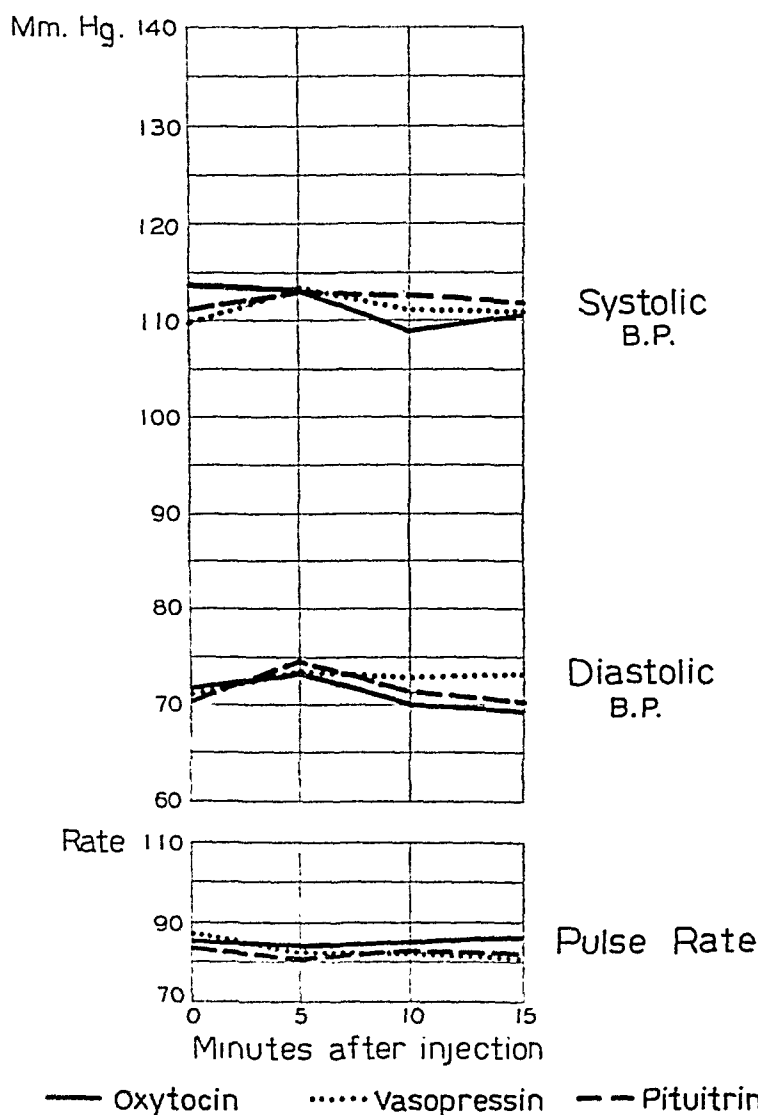


Fig. 3.—Showing average of 18 cases with one ampoule dosage.

A study of these tables demonstrates a definite difference in the effect on blood pressure of oxytocin in contrast to vasopressin and pituitrin. With oxytocin the blood pressures were uniformly lower than with the other products, and the pulse rate was slightly higher. It also appears that vasopressin increases the blood pressure slightly more than the pituitary extract. It was observed that the cases with low blood pressures showed a greater response to vasopressin than

those with high pressures, and that the response appeared more rapid with oxytocin, as vasopressin blanches the tissues, thus slowing absorption.

#### SUMMARY

1. Our study shows that in this series there was no *marked* difference in the oxytocic action of the oxytocin and pituitary extract. There appeared to be a *slight* difference in favor of oxytocin. The

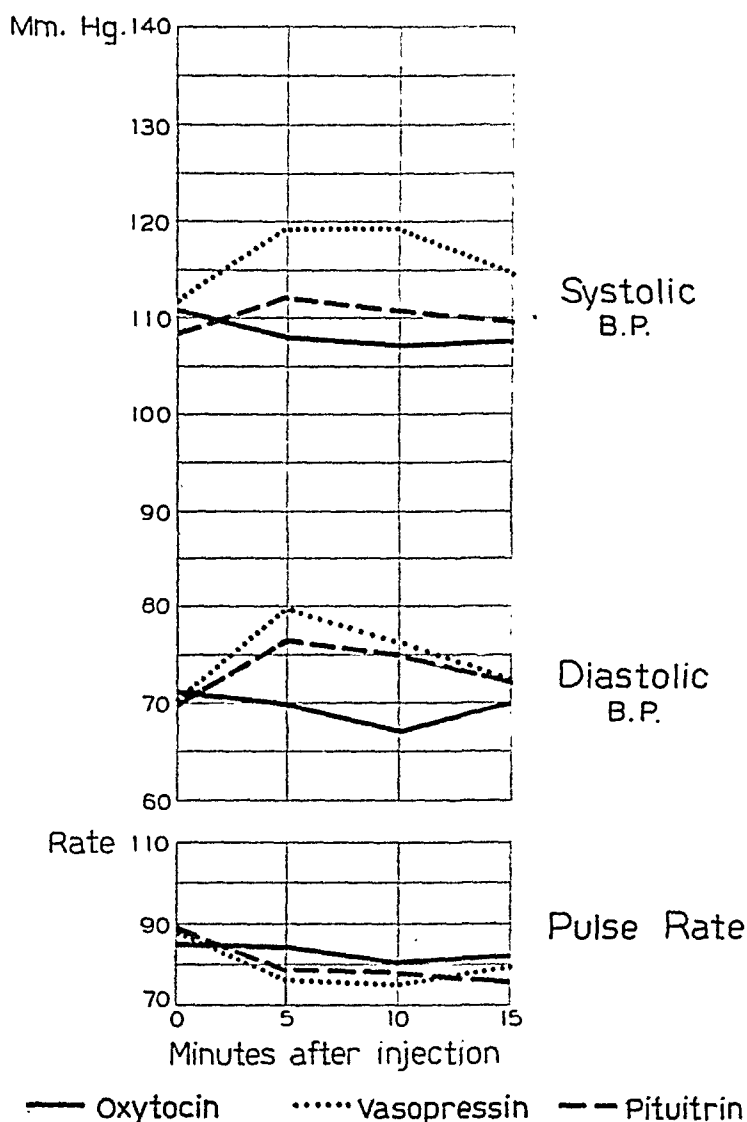


Fig. 4.—Showing average of 12 cases with two ampoule dosage.

oxytocin demonstrated that it fulfilled every requirement necessary for oxytocic action in obstetric usage. We are of the opinion, therefore, that it equals pituitary extract for obstetric purposes.

2. There is a definite difference in the blood pressure raising action of oxytocin as contrasted with vasopressin and pituitary extract, and vasopressin is somewhat more potent in this regard than pituitary extract.

3. The pulse rate is slightly lower with vasopressin and pituitary extract than with oxytocin.

4. The use of oxytocin would appear to be most desirable in those obstetric cases with high blood pressure, as in toxemia and eclampsia. Vasopressin would be indicated in cases of surgical shock to raise abnormally low blood pressure and in diabetes insipidus. Pituitary extract would probably be most suited for cases of postoperative atony of the intestines or bladder where the combined effect on the blood vessels and the nonstriated musculature was desired.

5. More extensive clinical observations are necessary to confirm the facts as demonstrated in this limited series.

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48 EAST FIFTY-SECOND STREET.

121 EAST SIXTIETH STREET.

(For discussion, see page 739.)

## A COMPARATIVE STUDY OF CERTAIN GYNECOLOGIC AND OBSTETRIC CONDITIONS AS EXHIBITED IN THE COLORED AND WHITE RACES\*

BY C. JEFF MILLER, M.D., NEW ORLEANS, LA.

ALTHOUGH technically the American negro has been free for more than half a century, in the South, at least, he is traditionally the servant of the white man, and it is poor psychology and false sentimentality to ignore that fact. By nature he is carefree, indifferent to responsibility, and quite without regard for the future. Likewise by nature his intellectual, moral, and social qualities are inferior to those of the white man, and this inherent weakness has been intensified by centuries of servitude, physical as well as psychologic. Thus his nature and his environment account for the fact that his race furnishes the largest proportion of indigent, dependent, and defective individuals in the South, a state of affairs which has apparently not been improved by the increasing number of negro insurance and sick benefit associations which have come into existence in recent years. The negro is the responsibility of the Southern physician and the Southern hospital, and it is a matter of self-preservation and an economic necessity that his health be safeguarded, quite aside from the humanitarian aspects of the question.

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The typical American negro of the present day, if he is of the pure black type, is a composite of the generic characteristics of the various primitive peoples from whom he is descended. But according to the last census at least a fifth of all American negroes exhibit some strain of white or Aryan blood, for legal restrictions, no matter how severe, are unable to prevent miscegnation entirely, and the resulting mulatto type furnishes a very real problem, medically as well as socially. Reliable data are lacking, but it is a generally accepted fact that the crossed strain has not the strength or the endurance of either of the pure races. The white blood loses more than the negro gains by the admixture. Superficially, at least, in this instance the law of Mendel ceases to function, for the offspring of such unions seem to inherit 100 per cent of the weaknesses of each race, and if intermarriage among the mulatto offspring continues, the resulting strain is feebler still.

The negro race does not adapt itself well to the strain of city life. Under it its natural fecundity is slowly disappearing, and for the last quarter of a century the negro birth rate, which was formerly far in advance of the white, has been some 40 per thousand less. It is also estimated that more than a quarter of all negro children born alive die before the fifth year, and that syphilis, tuberculosis, and secondary pneumonia cause among them a mortality 22 per cent higher than similar diseases cause among white children of the same age. Moreover, while such typical native diseases of the negro as yaws, elephantiasis and sleeping sickness have largely disappeared during their three centuries on the American continent, this gain has been more than offset by a loss of their natural immunity to the so-called diseases of civilization, notably malaria, tuberculosis, and nervous and intestinal diseases.

Whether Pearson's theory is correct, that the negro lies nearer to the common stem than does the European and so is nearer to the childhood of the race, I am not biologist enough to say, but my own experience is that of other clinicians, that his nervous system exhibits a lessened sensibility to pain and shock, and that the pure black type is the safest surgical risk to be found in our hospitals, though the mulatto is a poorer surgical subject than either of the pure races. The negro is an excellent subject for local anesthesia and he bears general anesthesia equally well unless his emotional nature has been aroused, in which case the excitement stage may be extreme. On the other hand, his habits of life are naturally unhygienic, his lack of moral sense leads to promiscuous mating, venereal disease is widespread, and his disregard of the prodromal symptoms of disease, unless pain is a feature, frequently means that the ultimate pathology offers very grave problems.



TABLE I. CHARITY HOSPITAL OF LOUISIANA 1917-1926

*Hospital Population and Bed Space\**

Total hospital population	204,584
55.7 per cent white, 44.3 per cent colored	
Total female admissions	79794
Divided approximately equally	
Gynecologic admissions	20477
44.3 per cent white, 55.7 per cent colored	
Obstetric admissions	17016
41.9 per cent white, 58.1 per cent colored	
Present number beds	1551
Average number during decennium	1230
10 per cent of total number gynecologic	
5.2 per cent of total number obstetric	

A comparative study of disease in the colored and white races is always enlightening, and as based on the records of the Charity Hospital of Louisiana it is truly representative because of the size of the institution and the enormous number of admissions. This is particularly true of the gynecologic and obstetric services. During the decennium which the present study covers, 1917-1926, the gynecologic admissions comprised more than 25 per cent of all female admissions and nearly 29 per cent of the colored female admissions, while the obstetric admissions comprised more than 21 per cent of the female admissions and nearly 11 per cent of the colored female admissions. In spite of the fact that approximately a third of the total hospital bed space is allotted to colored patients, the facilities are entirely inadequate and constant overcrowding is the result, so that in an unbelievable number of instances, especially on the gynecologic and obstetric services, two patients must be cared for in the same bed.

TABLE II

*Pelvic Disease*

6918 cases, 30.9 per cent white, 69.1 per cent colored
Incidence figured on female admissions
White 5.4 per cent, colored 11.9 per cent
Incidence figured on gynecologic admissions
White 23.6 per cent, colored 41.8 per cent
Mortality 194 (2.8 per cent)
White 2.2 per cent, colored 3.1 per cent

According to the Charity Hospital figures pelvic disease is roughly twice as frequent in colored women as in white, and basing my conclusions on the clinical history, the clinical study and the operative findings, I do not hesitate to say that probably 90 per cent of it is of specific origin, largely due to the high incidence of gonorrhea in the colored male and to the general racial habit of promiscuous sex relations. Laboratory examinations, of course, are no more successful in isolating the organism here than they are elsewhere. My experience is that in colored women infections of the lower genital tract seldom

\*Percentages throughout are figured to the nearest fraction.

remain local, and that almost always, given the same infecting agent, the disease tends to be more severe in them because they do not seek relief until pain and actual incapacity force them into the hospital. For this reason the resulting pelvic pathology may be almost incredible. It is not unusual to find multiple pus pockets, sometimes containing a quart or more of pus, scattered throughout the pelvis. Anatomic distortion of the pelvic viscera may be so extreme that all the usual landmarks are obliterated. Intestinal adhesions are often so dense that fistulas result from their release. Indeed, at operation one frequently marvels how these women have lived at all, let alone remained, as most of them do remain, in relatively good physical condition. Such extensive pathology, particularly when associated, as it very frequently is, with secondary ovarian disease, results in prolonged temperature elevations and necessitates long periods of cooling, which the colored patient often heartily resents; she may be slow in applying for relief, but, once she has applied, she can see no reason why she should not secure it immediately.

Obviously operation must be done in the great majority of cases, probably 90 per cent of them all. Quite aside from the pathology, the wholesale ignorance of the colored race prevents the employment of the isolation treatment which has given such brilliant results in the hands of Curtis and of others, and their improvidence does not permit of the experiments in conservatism which would be warranted in the white woman. Complete extirpation of the pelvic organs is frequently necessary, not only because of the specific origin of the pathology and its extent and severity, but also because of the social and economic considerations which can never be ignored in the negro.

#### TABLE III

##### *Chancroid*

164 cases, white 12.2 per cent, colored 87.8 per cent  
Incidence figured on female admissions  
White 0.05 per cent, colored 0.37 per cent  
Incidence figured on gynecologic admissions  
White 0.2 per cent, colored 1.3 per cent

##### *Condyloma*

41 cases, white 19.5 per cent, colored 80.5 per cent  
Incidence figured on female admissions  
White 0.02 per cent, colored 0.08 per cent  
Incidence figured on gynecologic admissions  
White 0.09 per cent, colored 0.3 per cent

##### *Vaginitis*

435 cases, white 77.4 per cent, colored 22.6 per cent  
Incidence figured on female admissions  
White 0.8 per cent, colored 0.2 per cent  
Incidence figured on gynecologic admissions  
White 3.7 per cent, colored 0.9 per cent

The fact that the colored mortality rate is only 0.9 per cent higher than the white is rather remarkable, in view of the extensive pathology and the consequent radical surgery, and to my mind it indicates quite conclusively that the colored woman has a greater resistance to trauma and to infection than has the white.

A greater frequency of chancroid and condyloma is to be expected among colored women because of the greater prevalence of venereal disease among them, and the two deaths from septicemia in the chancroid group prove that that disease is more virulent also. Vaginitis, on the other hand, is decidedly less frequent than among the whites, which, since the incidence of gonorrhea is much higher in colored women, seems to suggest a lessened sensitiveness of their vaginal tissues.

TABLE IV

*Fibroids of Uterus*

2991 cases, white 10.2 per cent, colored 89.8 per cent  
Incidence figured on female admissions  
White 0.8 per cent, colored 6.7 per cent  
Incidence figured on gynecologic admissions  
White 3.4 per cent, colored 23.5 per cent  
Mortality 146 (4.9 per cent)  
White 4.6 per cent, colored 4.9 per cent

*Lipoma of Vulva*

4 cases, all in colored  
Incidence figured on female admissions 0.01 per cent  
Incidence figured on gynecologic admissions 0.04 per cent

*Elephantiasis of Vulva*

18 cases, white 5.6 per cent, colored 94.4 per cent  
Incidence figured on female admissions  
White 0.003 per cent, colored 0.04 per cent  
Incidence figured on gynecologic admissions  
White 0.01 per cent, colored 0.1 per cent

Just why fibroids of the uterus should be so much more frequent in colored women than in white is not clear, but it is undoubtedly true that from a third to a half of all colored women over fifty years of age present this type of growth. It is the general impression that they are completely unknown among primitive African tribes, but it is hard to see any relation between their development and the increasing civilization of the negro. They originate earlier in negro women, probably because function develops earlier in them, and the frequent associated absolute or relative sterility is a particularly striking feature of the disease in a race that is ordinarily fecund.

My own experience is that both submucous fibroids and adenomyomas are less frequent in colored women than the other varieties, and the same fact, by the way, is true of endometriomas. Multiple growths of considerable size are the rule, and many times I have seen one hundred or more in the same patient. Growths reaching to the umbilicus, to the costal margin and even higher are quite frequent,

and in from 80 to 90 per cent of the colored patients the tumors can be palpated abdominally without any difficulty. More striking than the size and multiplicity of the growths, however, is the uniformity with which colored women seem to ignore their existence.

In these enormous tumors, veins as large as snakes sometimes course over the top and often can be palpated through the peritoneum before the cavity is opened. Rupture of such veins is a rare complication but I have personally seen it twice. Degeneration of all types is common, and calcareous degeneration, in particular, may be so extreme that the growth seems wholly mineral. Tubal disease is a complication of probably 90 per cent of all fibroids in colored women in the South, and is often so extensive that it is hard to say which is the primary pathology. Gonorrhea naturally explains much of it, but the pressure effects of the tumor cannot be ignored as a causative factor. In my experience it is the pain of this complication which brings the colored woman to the hospital more often than the discomfort of her tumor, large though it be.

It is rare that a fibroid in a colored patient does not require treatment. Irradiation and myomectomy are obviously possible only in the occasional case; the size and multiplicity of the growths and the prevalence of adnexal disease are definite contraindications to their use, while social and economic considerations again demand that that mode of treatment shall be instituted which will ensure a prompt and permanent cure. Hysterectomy is therefore necessary in some 98 per cent of all cases, and the high incidence of cervical infection demands the frequent employment of the complete operation, though cervical lacerations are comparatively rare. The problems of technic, as can be imagined, are frequently stupendous, due to the size of the tumors, their impaction in the pelvis, and the complications of the associated tubal disease, and it is again remarkable, in view of the wide difference in the pathology and in the extent of the surgery necessary, that the mortality rates in the two races should be so nearly identical.

Lipoma of the vulva was encountered only in the colored race during this decade, and seventeen of the eighteen cases of elephantiasis of the vulva were also in this race. A detailed study of the records would be necessary to establish how many of these were of the true parasitic type, but it is interesting to observe that even in these enlightened days colored women sometimes present this disease to a degree approximating the typical Hottentot apron.

In spite of a fairly general belief to the contrary, the statistics from this institution and from other clinics prove that carcinoma of the uterus is rather more frequent in colored women than in white. Predisposing obstetric lesions are certainly fewer among them, but the high incidence of predisposing cervical lesions more than offsets

TABLE V

*Carcinoma of Uterus*

1462 cases, white 39.2 per cent, colored 60.8 per cent  
 Incidence figured on female admissions  
 White 1.4 per cent, colored 2.2 per cent  
 Incidence figured on gynecologic admissions  
 White 6.3 per cent, colored 7.6 per cent

*Carcinoma of Breast*

528 cases, white 37.9 per cent, colored 62.1 per cent  
 Incidence figured on female admissions  
 White 0.5 per cent, colored 0.82 per cent  
 Mortality 48 (9.1 per cent)  
 White 12.5 per cent, colored 7.1 per cent

this gain. The prevalence of fibroids in the colored race would seem to suggest that the incidence of fundal carcinoma would be materially higher among them, but our records do not support this view, possibly because our laboratory examinations are inadequate. The colored woman is apparently no more dilatory in applying for treatment than is her white sister, and among both races, because of the class from whom the hospital population is drawn, the percentage of hopeless cases is very high. The operative incidence is certainly not more than 1 per cent, and in an appalling number of cases only palliative treatment is possible. The colored patients exhibit an unusually high percentage of ugly complications, especially fistulas; in some instances these may be due to ill-advised irradiation, but undeniably the incidence is increased by their general disregard of the laws of hygiene and of ordinary cleanliness, as well as by the incidence of rectal syphilis.

The mortality rates, 8 and 6.6 per cent respectively, mean nothing, partly because of the type of treatment, which is practically always by irradiation or by palliative measures, and partly because of hospital conditions: through the efforts of the social service many patients formerly kept in the hospital until death are now handled by other agencies or at home, to permit the bed space to be utilized for those who can be helped, while on the other hand, many patients are admitted to the hospital to die, in an astonishing number of instances admitted actually moribund, because they cannot be cared for elsewhere.

Carcinoma of the breast is likewise more frequent among colored women, though the mortality, which I believe is mainly surgical, is considerably less. Carcinoma has become a common disease in the American negro only within the last few generations, possibly for the same reason that it is becoming more frequent among the whites, greater longevity and a more accurate certification of the causes of death. This does not, however, explain its relatively higher incidence among them, and we are forced to the conclusion that the preponderance of genital and breast malignancy among them is a true racial peculiarity.

TABLE VI. OBSTETRIC INJURIES

*Perineal Injuries*

886 cases, white 80.6 per cent, colored 19.4 per cent  
 Incidence figured on female admissions  
 White 1.8 per cent, colored 0.4 per cent  
 Incidence figured on gynecologic admissions  
 White 7.9 per cent, colored 1.5 per cent

*Cervical Injuries*

1083 cases, white 82.2 per cent, colored 17.8 per cent  
 Incidence figured on female admissions  
 White 2.5 per cent, colored 0.5 per cent  
 Incidence figured on gynecologic admissions  
 White 9.8 per cent, colored 1.7 per cent

*Retrodisplacements*

1001 cases, white 70.6 per cent, colored 29.3 per cent  
 Incidence figured on female admissions  
 White 1.87 per cent, colored 0.74 per cent  
 Incidence figured on gynecologic admissions  
 White 7.8 per cent, colored 2.6 per cent

*Fistulas*

164 cases, white 32.3 per cent, colored 67.7 per cent  
 Incidence figured on female admissions  
 White 0.14 per cent, colored 0.28 per cent  
 Incidence figured on gynecologic admissions  
 White 0.6 per cent, colored 0.96 per cent

Obstetric injuries, with the single exception of fistulas, are decidedly less frequent in colored women than in white, as would be expected in a race which bears its children largely without mechanical aid, both because they are smaller and because the head circumference is less. Levy's detailed study of five hundred cases of each race from the obstetric clinic of Touro Infirmary substantiates these points absolutely, and his (unpublished) figures based on the same study show, as do ours, a relatively small percentage of cervical and perineal injuries and of uterine displacements. Fistulas, however, are considerably more frequent in colored women than in white, and often they are of an extremely ugly type, because of lack of cleanliness, and, in the case of rectal fistulas, because of the high incidence of rectal syphilis. Fistulas are comparatively infrequent in white women today because the general standard of obstetric practice is materially improved over what it was a generation ago, but this is not the case, unfortunately, with colored women, in whom the majority of deliveries are handled outside of the hospital, either by midwives or by inexperienced practitioners. They are usually saved from meddling interference because they bear their children so easily, but when complications do arise and labor is unduly prolonged, fistulas of the sort seldom found in white women today are an inevitable consequence. It is comparatively rare for any sort of obstetric injury except fistulas to be encountered on my own colored service, where, because of the high yearly turnover, in the run of things a fair number could be expected.

Since salpingitis is an accepted cause of ectopic pregnancy, one would expect the incidence of the latter condition to be considerably more frequent in colored women, whereas the figures (1.8 and 1.5 per cent respectively) show it to be slightly less. It is a remarkable and inexplicable fact that all of the eleven ectopic pregnancies which went to term during the period covered by the hospital records (1906 to date) occurred in colored women.

#### TABLE VII

##### *Deliveries*

9693, white 36.4 per cent, colored 63.6 per cent  
Abnormal deliveries 675 (7 per cent)  
White 11.1 per cent, colored 4.5 per cent

##### *Abortions*

2186, white 56.6 per cent, colored 43.4 per cent  
Incidence figured on obstetric admissions  
White 17.3 per cent, colored 9.6 per cent

##### *Premature Labors*

359, white 41 per cent, colored 59 per cent  
Incidence figured on obstetric admissions  
White 2.05 per cent, colored 2.1 per cent

##### *Stillbirths*

1024, white 30 per cent, colored 70 per cent  
Incidence figured on deliveries  
White 8.6 per cent, colored 11.6 per cent

##### *Premature Births*

511, white 44.8 per cent, colored 55.2 per cent  
Incidence figured on obstetric admissions  
White 3.2 per cent, colored 2.8 per cent

The tremendous demand on the colored obstetric service at Charity Hospital is borne out by the fact that while during this decade the ratio of colored to white obstetric beds was less than 3 to 7, the ratio of deliveries was more than 6.5 to 3.5. Abnormal deliveries, as these figures show, are comparatively rare among colored women, chiefly for the reasons we have already set forth, the smaller size of the child and the smaller circumference of its head. To this might be added a less scientific reason, that forceps applications are seldom made in colored women to terminate a labor which is progressing normally, albeit slowly, because their lessened sensibility to pain makes them slower to demand relief than white women. Indeed, the number of abnormal deliveries in both races is comparatively small, in view of the many "operative possibilities," to use Williams' expression, which naturally occur in a public hospital of this size. Except possibly in the case of cesarean section, in which in New Orleans as elsewhere obstetric judgment sometimes ceases to function, the indications for interference on both colored and white services seem to have been reduced almost to rock bottom.

The incidence of contracted pelvis is slightly greater among white women (0.76 per cent to 0.37 per cent), in marked contrast to the relatively high incidence reported by Williams for the colored service at Johns Hopkins. The explanation, however, is not far to seek: he works in a city which is essentially Northern in mode of life and his patients live in tenements and in typical tenement surroundings, whereas the negro of the far South, both in the city and in the surrounding country, whatever else he may lack has in abundance fresh air and sunshine, those two arch enemies of rickets. Levy's report from the Touro Clinic, I might add, corroborates these findings as to the relatively small percentage of contracted pelvis among colored women in this part of the country.

The real figures for both abortion and premature labor in colored women are, I believe, considerably higher than the hospital records indicate. Because the colored woman bears her children so easily, she is prone to ignore obstetric conditions unless they become pathologic, and for this reason the hospital admissions for both abortion and premature labor are likely to be less on the colored service than on the white. Both accidents, as a matter of fact, are probably considerably more frequent in the colored race because of the higher incidence of syphilis. A study of the city health records would be necessary to establish this point statistically, but from casual observation I feel safe in saying that the incidence of syphilis on the colored obstetric service at Charity Hospital probably runs between 12 and 15 per cent. This is higher than Levy's report of 7.8 per cent from the Touro Clinic, but less than Williams' report of 16.2 per cent from Johns Hopkins, McCord's of 30 per cent from the Emory Clinic, and Bartholomew's of 34 per cent from Grady Hospital. The results of antisyphilitic treatment are as brilliant here as elsewhere, but unfortunately the negro woman does not usually report to the clinic early enough in her pregnancy to make it either possible or effective.

Stillbirths are 3 per cent higher among negroes than among whites, again due to syphilis, as would be suggested by the large number of macerated feti in the absence of toxic complications, quite aside from a study of the maternal and cord Wassermanns. The mortality among premature babies is also higher in this race, 93.3 per cent as against 88.6 per cent in the whites. These statistics, I might add, are not as damning as they seem, for the reason that approximately a third of these children were born before admission to the hospital, and also for the reason that the record room follows the very unscientific and inaccurate plan of registering as premature all infants born alive before term, regardless of whether or not they have reached the period of viability, which naturally increases the death rate out of all proportion to what it would be under more scientific methods of calculation.



TABLE VIII

*Septicemia*

234 cases, white 56 per cent, colored 44 per cent  
 Incidence figured on obstetric admissions  
 White 1.8 per cent, colored 1.04 per cent  
 Mortality 75 (32 per cent)  
 White 30.6 per cent, colored 33.9 per cent

*Eclampsia*

259 cases, white 42.1 per cent, colored 57.9 per cent  
 Incidence figured on obstetric admissions  
 White 1.5 per cent, colored 1.5 per cent  
 Mortality 111 (42.9 per cent)  
 White 36.7 per cent, colored 47.3 per cent

I need scarcely say that only a negligible number of the cases of septicemia handled during the decennium developed in patients delivered entirely under hospital supervision. The higher incidence in white women is easily explained by the fact that interference during labor, the most frequent causative factor, is more frequent among them than among colored women, while the higher mortality among the negroes is plainly due to their disregard of the condition in its early stages, when it might be amenable to treatment. This same fact, I believe, explains the very high mortality of eclampsia among the colored (10.6 per cent higher than among the whites), although the incidence of the disease is exactly the same in both races. It is naturally difficult to institute accurate comparisons in this regard, since the methods of treatment on the various services often differ radically, but it is only fair to the hospital to add that conservative treatment is now practically routine. Formerly the general hospital mortality ranged between 35 and 43 per cent, but for 1927, with conservative treatment practically uniform on all services, it was roughly 15 per cent, and on the service of which I was formerly chief and which is now in charge of my successor and former associate, E. L. King, it has been reduced to less than 10 per cent.

TABLE IX

*Placenta Previa*

81 cases, white 64.2 per cent, colored 35.8 per cent  
 Incidence figured on obstetric admissions  
 White 0.73 per cent, colored 0.3 per cent  
 Mortality 22 (27.2 per cent)  
 White 19.2 per cent, colored 41.4 per cent

*Vomiting of Pregnancy*

149 cases, white 65.8 per cent, colored 34.2 per cent  
 Incidence figured on obstetric admissions  
 White 1.4 per cent, colored 0.5 per cent  
 Mortality 20 (13.2 per cent)  
 White 14.3 per cent, colored 11.8 per cent

Why placenta previa should be more frequent among white than among colored women it is not possible to say, though the markedly higher mortality in the colored—the difference is 22.2 per cent—is

easily explained by the fact that the negro woman is more likely to ignore the initial hemorrhage, particularly if it be not severe, and therefore is more likely to be infected prior to admission. Also it is not possible to say why the graver forms of the vomiting of pregnancy should be less frequent among colored women. True toxic vomiting is especially rare, but it is seen, and the gravity of the condition when it does occur is proved by the fact that the colored mortality for this complication of pregnancy is only 2.5 per cent less than the white. Here also it should be stated that the general hospital mortality has recently shown a marked decrease with the substitution of intravenous therapy for empiric methods of treatment and particularly for the late induction of abortion.

TABLE X

*Maternal Mortality*

Figured on deliveries 198 (2 per cent)
White 2.3 per cent, colored 1.9 per cent
Figured on obstetric admissions 404 (2.4 per cent)
White 2.7 per cent, colored 2.2 per cent

In spite of all the untoward factors which operate in the colored race the maternal mortality, no matter how figured, is less than it is among white women, another proof, I would say, of their naturally higher resistance to trauma and to infection. Eclampsia, however, was responsible for 31.7 per cent of the deaths among white women at delivery and for 44 per cent among colored women, while placenta previa was responsible for 8.5 per cent of similar deaths among the white and 9.5 per cent among the colored. I need scarcely point out

TABLE XI. SURGICAL DISEASES\*

*Chronic Appendicitis*

6931 cases, white 81.5 per cent, colored 18.5 per cent
Incidence white 4.93 per cent, colored 1.4 per cent
Mortality 71 (1.02 per cent)
White 0.0078 per cent, colored 2.1 per cent

*Acute Appendicitis*

1901 cases, white 68 per cent, colored 32 per cent
Incidence, white 1.13 per cent, colored 0.7 per cent
Mortality 294 (15.4 per cent)
White 14 per cent, colored 18.7 per cent

*Cholecystitis*

466 cases, white 81.8 per cent, colored 18.2 per cent
Incidence white 0.3 per cent, colored 0.09 per cent

*Cholelithiasis*

84 cases, white 89.3 per cent, colored 10.7 per cent
Incidence white 0.065 per cent, colored 0.01 per cent

*Nephrolithiasis*

48 cases, white 89.6 per cent, colored 10.4 per cent
Incidence white 0.04 per cent, colored 0.005 per cent

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\*All percentages figured on total hospital admissions.

that the analysis of death rates in a hospital of this type is scarcely fair, since it is literally the dumping ground for all the neglected complications of pregnancy and all the mismanaged deliveries not only in the city but also in the adjacent state, and since patients are often admitted in extremis and beyond human aid, however skillful it may be.

Certain surgical diseases are sufficiently different in the two races to warrant their brief mention, even though it transcends the limits of my subject. Thus chronic and acute appendicitis are both several times more frequent in the white race, though the mortality in the colored is considerably higher. As Matas pointed out years ago, the preponderance of lymphoid tissue in the colored would lead us to expect exactly the reverse of these findings, and as far as I know, no reasonable explanation of the facts has ever been advanced. Matas' report naturally includes only a very small number of cases, since the disease was just beginning to be recognized at the time it was written, but his conclusions are amply confirmed by the present study.\*

All types of gall bladder pathology are less frequent in the colored race, and gallstones are decidedly rare. In the 196 cases collected from the records by Bloch, only 17 were in negroes. He arrives at no definite conclusions as to the reason for this marked discrepancy, since the main predisposing factors are apparently the same in both races, the only apparent difference being a relatively minor one, that the active and outdoor occupations habitual with the negro may be responsible for a lesser degree of stagnation in the bile passages.

Likewise nephrolithiasis is decidedly infrequent among negroes, the incidence for this decennium being even less than that reported by Matas thirty years ago. The condition is admittedly rare among both races in the Gulf States, though why this should be so has never been satisfactorily explained.

In the limitations of space which I have had to observe I have been able to do little except to call attention to the varying incidence of certain diseases in the white and colored races, and to point out certain clinical problems as they are exhibited especially in colored women. This is not a truly scientific study, nor, for that matter, is it a clinical paper. When the material for a dozen lengthy monographs must be compressed into a few pages, the results can be only superficial. A study of this sort, to be of real value, would require a careful analysis of individual records, a tabulation of the results by a trained statistician, and finally their interpretation by a skilled clinician working with an equally well equipped ethnologist. As Matas pointed out many years ago, the records of Charity Hospital

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\*I regret very much that because of the different premises as well as the changes in diagnosis and nomenclature during the last thirty years it has not been possible to institute detailed comparisons between his report and my own, as I had originally hoped to do.

form a veritable treasure house for the student of racial pathology, and I have presented this very imperfect discussion in the hope of calling attention to their manifold and as yet barely touched possibilities. If they are ever properly evaluated, there is no branch of medicine which will not profit thereby.

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512 HIBERNIA BUILDING.

(For discussion, see page 725.)

## RELAXATION OF THE ANTERIOR VAGINAL WALL\*

WITH A REPORT OF THE END-RESULTS IN A SERIES OF 100 CASES

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RECENT improvements in operative technic and careful selection of cases have brought about a comparative uniformity of good results in patients operated upon for cystocele. Nevertheless, occasional cases are still encountered in which the postoperative condition is not entirely satisfactory.

A few such instances came to our notice in the Follow-Up Clinic and this analysis was undertaken in an effort to determine the cause of the occasional poor functional result in those cases in which the anatomic restoration appeared good. The study is based on the records of one hundred cases of cystocele. The series represents the work of six members of the staff of the John Goodrich Clark Gynecologic Clinic of the Hospital of the University of Pennsylvania. Each case included in the series has been followed closely for at least twelve months from the date of operation, and each patient has been examined by a member of the gynecologic staff. The cases are not selected as the series is made of consecutive followed-up cases operated upon prior to January 1, 1926.

The cases were studied from two standpoints, the anatomic result and the functional result. In classifying them a more or less arbitrary scale was necessarily adopted; for cases in which there was a firm restoration of the supporting structures and in which there was no descensus of the anterior vaginal wall on straining the term "per-

\*Read at a Joint meeting of the New York, Philadelphia and Boston Obstetrical Societies, held in New York, April 10, 1925.

fect anatomic result" has been used. The term "fair anatomic result" designates those cases in which there remains a small urethrocele or a slight bulging of the anterior vaginal wall on increase of pressure. The cases of recurrence are grouped under the term "poor anatomic result."

TABLE I. ANATOMIC RESULTS

	PER CENT
Total number of cases	100
Perfect anatomic result	86
Fair anatomic result	10
Poor anatomic result	4

In Table I the anatomic results obtained from various operative procedures are grouped together. In the choice of the type of operation to be used each case is considered on its own merits and that procedure is carried out which best meets the requirements of associated lesions. Consequently, five different combinations of operative procedure were utilized in this group of cases.

TABLE II. ANATOMIC RESULTS WITH REFERENCE TO TYPE OF OPERATION

TYPE OF OPERATION	GOOD	FAIR	POOR
Anterior colporrhaphy	90.1%	8.4%	1.5%
Vaginal hysterectomy and anterior colporrhaphy	63.3%	28.5%	7.2%
Suspension and anterior colporrhaphy	100.0%		
Watkins' interposition operation	66.6%		33.3%
Abdominal hysterectomy and anterior colporrhaphy	100.0%		

From a study of Table II, it appears that better results were obtained in those cases in which the uterus was either suspended or removed by the abdominal route. Gravity and intraabdominal pressure are important causative factors in the production of recurrences. If the uterus is left in or subsequently assumes a position parallel with the long axis of the body, intraabdominal pressure is exerted upon the fundus and the cervix is necessarily forced downward. The only restraining structures are the ligaments and the recently repaired pelvic floor. On the other hand, if the uterus is left in well-marked anteversion this spear head or wedge-like action is nullified. When a vaginal hysterectomy is performed and the bases of the broad ligaments overlapped and their upper portions strongly sutured to the symphysis, after the manner suggested by G. G. Ward, a strong shelf is secured and recurrence is unlikely. The high percentage, 90 per cent, of good results in the 54 cases treated by simple anterior colporrhaphy, was most encouraging. We feel, however, that this can be improved considerably by more care in the preliminary study of the cases, and definite attention to the urethrocele, if such a lesion is present. Too often the incision in the anterior vaginal wall was not extended far enough anteriorly. On this error we blame the few cases of persistent or recurrent urethrocele.

Following the study of the anatomic results we investigated the postoperative vesical function. In our series of 100 cases seventy-six patients complained of vesical symptoms prior to operation. The remaining twenty-four patients complained of no urinary symptoms and sought relief only on account of the uncomfortable protrusion from the vaginal orifice. The chief symptoms encountered were frequency of urination, incontinence of urine, and difficulty in starting the flow. This last symptom in most of the cases, could be overcome by manual replacement of the cystocele. In classifying the results more or less arbitrary groups were necessarily formed. In Table III the term "perfect postoperative functional result" designates those patients in whom there was no abnormality of vesical function following the repair. The terms "improved" and "unimproved" are self-explanatory.

TABLE III. FUNCTIONAL RESULTS

Number of patients with preoperative vesical symptoms	76.0%
Perfect postoperative functional results	84.2%
Improved postoperative functional results	11.8%
Unimproved postoperative functional results	3.9%

In comparing Table I and Table III, it will be seen that the anatomic and functional results are practically equal in each of the groups. It was surprising, however, to find that, with only one exception, all of the patients with fair or poor anatomic results had perfect vesical function; and, further, that all of the patients with persistent urinary complaints showed, on examination, a perfect anatomic result from operation. In other words, a poor anatomic result is compatible with perfect vesical function, and vice versa as determined by the ordinary pelvic examination.

The functional results were analyzed according to the type of operation utilized in repair of the cystocele. This analysis is found in Table IV.

TABLE IV. FUNCTIONAL RESULTS WITH REFERENCE TO TYPE OF OPERATION

OPERATION	PERFECT RESULT	IM- PROVED	UNIM- PROVED
Anterior colporrhaphy	85.2%	11.1%	3.7%
Vaginal hysterectomy and anterior colporrhaphy	81.9%	18.1%	-----
Abdominal hysterectomy and anterior colporrhaphy	*100.0%	-----	-----
Watkins' interposition operation	60.0%	20.0%	20.0%
Suspension and anterior colporrhaphy	†100.0%		

\*1 Case.

†5 cases.

TABLE V. ANALYSIS OF RELIEF FROM INDIVIDUAL SYMPTOMS

SYMPTOM	NUMBER OF PREOPER- ATIVE COMPLAINTS	RELIEVED	IMPROVED	UNIMPROVED
Frequency	48	87.5%	10.5%	2.0%
Dysuria	29	89.6%	10.4%	-----
Incontinence	32	84.4%	6.3%	9.3%

A further analysis was made to determine the percentage of cases in which each of the individual preoperative vesical symptoms was relieved by operation. These results are shown in Table V.

The most annoying postoperative symptom is the persistence of incontinence, which, in our series, occurred in 15.6 per cent of all patients who sought relief from this symptom. As stated previously, with only one exception, all of the patients in whom the incontinence was not relieved had apparently perfect anatomic results following operation as far as could be determined by the ordinary clinical criteria. Believing, however, that the persistent incontinence is due to



Fig. 1.—Normal bladder of a nullipara. Standing, photograph taken anteroposteriorly. Attention is called to the fact that the outline of the base of the bladder is practically horizontal and does not extend below the level of the center of the symphysis.

a definite relaxation or tear of the urethral sphincter, an attempt was made to demonstrate this fact by x-ray examination.

*Technic.*—Six or eight ounces of a 10 per cent sodium iodide solution is injected into the bladder through a soft rubber catheter by the gravity method. The x-ray is focused over the center of the symphysis and the exposures are made directly anteroposteriorly. Four plates are taken, two with the patient recumbent and two in the standing posture. The first exposure in each position is made with normal intraabdominal pressure, and the second is taken while the patient is "bearing down." We have employed this technic in a consecutive series of cases and in none has injury resulted. This technic in general is similar to that developed by Ferguson\*. A series of normal cases was studied, particularly noting

\*Ferguson, L. K.: Surg. Clin. N. Am., 1926, vi, No. 1, 70.

the change in the outline of the base of the bladder when the patients were asked to increase the intraabdominal pressure. A typical picture of the bladder of a nulliparous patient shows the outline of the base of the bladder, while the patient is "straining" forcibly. Attention is called to the horizontal line in the region of the internal sphincter. In other words, there is no apparent weakness in this area.

This picture is to be compared with Fig. 2. This patient presented a perfect anatomic result following a simple anterior colporrhaphy. The incontinence of urine, however, persisted after operation. The cystogram shows a very definite weakness of the base of the bladder on increase of intraabdominal pressure. The cone-shape of the base line is typical of that seen in all of the cases of incon-



Fig. 2.—Relaxation of the urethral sphincter. In this case a large cystocele and urethrocele were present. The former was repaired thirteen months prior to this photograph having been taken. Patient was incontinent before operation, and this symptom was not benefited despite the fact that the cystocele was cured as far as could be demonstrated by the ordinary clinical methods. The x-ray shows the typical funnel-shaped appearance in the region of the internal urinary meatus.

tinence which we have examined by this technic. Fig. 3 is a case similar to the one shown in Fig. 2 and presents the same distortion of the base of the bladder.

The x-ray is also of value as a preoperative procedure. By it the surgeon cannot only demonstrate that such a lesion is present but is enabled to estimate to an extent, at least, the amount of relaxation of the sphincter which is present and is thereby enabled to perform a more efficient repair. The points which we wish to emphasize are: (a) That a relaxation of the sphincter is a cause for incontinence, (b)



the lesion must be recognized in order to perform a satisfactory repair and so cure the incontinence, (c) that relaxation of the sphincter cannot always be recognized by the ordinary clinical methods, (d) that the x-ray offers a practically certain means of recognizing the condition and also the extent of the lesion, (e) that the x-ray may be employed as a postoperative measure in order to determine the efficiency of the operation, (f) and, finally that the x-ray is especially valuable as a means of testing the integrity of the internal sphincter in those cases which have been repaired, often with an apparently excellent anatomic result, but in which the incontinence persists.



Fig. 3.—The history of this case is similar to that shown in Fig. 2. A plastic operation was performed for a large cystocele. The incontinence, however, continued. The x-ray examination shows the typical funnel-shaped opening of the urethra indicating a dilatation of the sphincter.

Occasionally, this incontinence persists after the repair of the cystocele even when an apparently perfect anatomic result has been secured. In the latter group of cases, if the technic of Ferguson\* is employed, the x-ray picture will show that the internal portion of the urethra is dilated and instead of being a tube of fairly uniform diameter it is funnel shaped. The recognition of the condition prior to operation is, therefore, important.

\*Ferguson, L. K.: Surg. Clin. N. Am., 1926, vi, No. 1, p. 79.

The condition may occur in two ways: (a) a direct tear during delivery, or, (b) from the constant dragging upon the sphincter due to the presence of a cystocele which finally results in the weakening, relaxation, and dilatation of the sphincter and the development of partial incontinence. This latter method of development is by far the most common. This relaxation of the sphincter should not be confused with the localized hypertrophy of the vaginal mucous membrane which occurs in the same region and is such a common accompaniment of a cystocele. The latter has no relation to the integrity of the sphincter. The funnel-shaped appearance of the urethra, as observed in the x-ray pictures, is characteristic of the former condition and is absent in uncomplicated cystoceles.

Various operations have been devised for correcting the relaxation of the sphincter. Our own plan is to carry the denudation of the anterior wall well forward to the urethra, to, at least, 1.5 or 1 cm. of the external urinary meatus and shorten the relaxed sphincter by three or four carefully placed fine catgut sutures, as shown in the diagram.

#### CONCLUSIONS

1. Relaxation of the anterior wall is of frequent occurrence.
2. These lesions frequently develop gradually and often occur in patients in whom there has never been any demonstrable tear in the vaginal mucosa.
3. Cystocele is much more frequent in stout than in thin women. It is probable that the intraabdominal pressure is decidedly greater in the former than in the latter type of patients.
4. Partial incontinence, especially upon straining or coughing, is one of the most frequent and annoying symptoms of the condition.
5. Incontinence is rarely, if ever, present unless the sphincter is injured.
6. A definite differentiation between the two lesions should be made.
7. When the sphincter is involved, partial incontinence is a frequent accompaniment. Although commonly concomitant, these lesions are not necessarily so, and incontinence may be a marked symptom in a case in which the actual vesical lesion is relatively insignificant.
8. The reverse may also be true. A large cystocele may be present and if the urethra is intact, incontinence is not likely to be present.
9. Relaxation of the sphincter may be easily demonstrable. In many cases its presence can be detected by directing the patient to strain or cough. In some instances, it is much more difficult to determine, and this is especially likely to be the case when the base of the bladder is in relatively normal position.
10. Not infrequently the vaginal mucosa covering the posterior portion of the urethra becomes hypertrophied. This hypertrophy may

exist alone but is a common accompaniment of a cystocele. This hypertrophy bears no relationship to the integrity of the sphincter.

11. The fluoroscopic examination or x-ray pictures taken with the bladder filled to capacity with an opaque liquid, as previously described, is a direct aid in demonstrating these lesions.

12. Relaxations of the sphincter may be demonstrated by the x-ray which cannot be detected by the ordinary clinical methods.

13. To cure incontinence due to relaxation of the sphincter, its presence must be recognized and the anterior colporrhaphy modified accordingly.

14. Lack of attention to this detail may result in an apparently excellent anatomic result with, however, failure to relieve the incontinence.

15. Postoperative x-ray examinations are of great practical value in determining the degree of restoration secured.

16. No one type of operation is applicable to all cases if the best results are to be secured.

17. The selection of the type of operation and previous knowledge of the actual lesion present is of the utmost importance.

18. Care in the performance of the operation is equally important. Absolute hemostasis is essential. A small hematocele, insignificant in itself, may result in failure to secure a symptomatic cure as may carelessness in the placing of one or two of the important sutures.

TWENTY-SECOND AND CHESTNUT STREETS.

(For discussion, see page 743.)

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## FISTULA OF THE UTERUS

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**F**ISTULA of the uterus occurs with relative infrequency following operations on the uterus and adnexa. Sixteen cases have been observed at the Mayo Clinic, including only those in which there was a communication, either direct or through a fallopian tube, between the uterus and the abdominal wall. Fistulous tracts leading from the uterus to other organs or to the surface of the body in situations other than the abdominal wall, are not discussed here.

### SYMPTOMS

The symptoms of fistula of the uterus are characteristic, indeed almost pathognomonic. Following operation complete healing fails to occur or primary healing apparently occurs, and later an area of fluctuation, usually coincident with a menstrual period, appears. In

some instances there is malaise and elevation of temperature until the fistula is definitely established. When such an area of fluctuation does not rupture spontaneously, or is not incised when it first appears, it may temporarily decrease in size. With the onset of succeeding menstrual periods more fluid accumulates and is eventually released by spontaneous rupture or surgical drainage. The fluid which escapes is blood-tinged. Menstruation occurs subsequently both by the normal route and through the fistula.

The amount of blood discharged through the fistula varies depending on the size of the opening, the amount of menstrual flow, and the relative patency of the cervical canal. During the intermenstrual period the discharge becomes serous or purulent and diminishes. In an occasional case in which there is little inflammation, the fistula may show a tendency to close between menstrual periods.

Complications may modify these symptoms slightly. The fistula may communicate with viscera other than the uterus. Such a communication with the intestine results in the escape of gas and fecal material. If there is a communication with bladder or ureter, urine may pass through the fistula. Foreign bodies in the pelvis that act as a focus in some of these fistulas may be discharged piece-meal to the surface and be noted by the patient.

Sinuses that extend down to, or only partially penetrate, the uterine wall are not associated with periodic discharge of blood, such as occurs with true fistulas of the uterus.

#### DIAGNOSIS

The diagnosis of fistula of the uterus usually depends on the existence of a postoperative abdominal fistula which periodically discharges blood coincident with menstruation. Such a condition is found in the presence only of one other lesion: a postoperative fistula communicating with an area of misplaced endometrial tissue in an extrauterine adenomyoma or hemorrhagic cyst of the ovary as described by Sampson, discharging blood coincident with menstruation. This condition is so rare that it need hardly be considered. In Shaw's case, which he believed to be the only one of its kind reported in the literature, exploration had been carried out in 1914 and double uterus diagnosed. Ten years later a fluctuating mass appeared in the right groin; it was incised, and black tarry fluid escaped. A fistula persisted and discharged blood coincident with menstruation for four months. At the second operation, in 1924, hysterectomy and bilateral oophorectomy were performed. A mass in the round ligament, with which the fistula communicated, was not removed because of technical difficulties and because it was believed to be an adenomyoma which would atrophy after removal of both ovaries. After operation the fistula closed spon-

taneously and the patient was entirely well six months later. Examination of the right ovary disclosed adenomyoma.

The diagnosis of fistula of the uterus may be confirmed by the introduction of colored fluid into the fistula and observing its escape through the cervix. When the tract is not tortuous, a sound or probe introduced into it may be brought out through the cervix, or a metallic click may be elicited by the approximation of the ends of two sounds, one of which is introduced in this manner through the fistula and the other through the cervix. If substances opaque to roentgen rays are injected through the fistula they should produce a roentgenographic shadow sufficiently characteristic to suggest communication with the uterus.

In other abdominal fistulas there may be bleeding from granulations, and there may be some increase in the amount of bleeding from congestion coincident with menstruation, but in such fistulas the blood is bright red and scanty and association with menstruation is not constant. That they do not communicate with the uterine cavity can be conclusively demonstrated with sounds and the use of colored fluids.

#### ETIOLOGY

In all of the cases discussed here formation of the fistula dated from an operative procedure. The primary operation consisted of partial or complete salpingectomy or salpingo-oophorectomy on the side on which the fistula developed in seven cases, oophorectomy alone in one case, oophorectomy and partial resection of the uterus in one case, appendectomy for ruptured appendix in two cases, and drainage of pelvic abscess in five cases.

TABULATION. OPERATIVE DATA IN SIXTEEN CASES OF FISTULA OF THE UTERUS

CASE	OBSERVATIONS AT FIRST OPERATION	SIGNIFICANT OBSERVATIONS AT FISTULECTOMY
1.	Acute left pyosalpinx	Adhesions of left ovary; chronic right salpingitis
2.	Appendicitis and bilateral salpingitis	Fibromyoma uterus and chronic salpingo-oophoritis
3.	Pelvic abscess	Bilateral tuberculous salpingitis
4.	Tuberculosis	Tuberculous salpingitis
5.	Pelvic abscess	Chronic salpingitis
6.	Tuberculous peritonitis	Tuberculous salpingitis and peritonitis
7.	Ruptured appendix	Ovarian abscess
8.	Appendicitis	Tubo-ovarian abscess
9.	Indefinite	Tuberculosis
10.	Tubo-ovarian abscess	Inflammatory mass; three silk worm sutures
11.	Pelvic abscess	One silk worm suture; slight inflammation
12.	Pelvic abscess	Chronic salpingitis; nonabsorbable sutures
13.	Tuberculous peritonitis	Chronic salpingitis
14.	Pelvic abscess*	
15.	Ruptured extra-uterine pregnancy	Inflammatory mass
16.	Ruptured appendix	Tubo-ovarian abscess

\*No operation.

Tuberculosis of the tube or ovary was diagnosed at operation in five cases and in two there was generalized tuberculous peritonitis. In three of the eleven nontuberculous cases nonabsorbable suture material was removed at the second operation.

Operations performed during the acute stage of pelvic infection or during the abscess stage are usually necessarily incomplete and are often limited to drainage. It was usually following such operations that fistulas developed. In only one case did the fistula develop following salpingectomy for extrauterine pregnancy; at a second operation there was evidence of infection. Fistula secondary to cesarean section was not observed in the series. Tuberculous inflammation, characterized by its tendency to fistula formation, especially following operative procedures, was the second most common etiologic agent. Nonabsorbable suture material used in the presence of infection was third in order of frequency as the cause of the fistula. Sutures of this type may be used with impunity in the pelvis when infection is absent but in the presence of infection they are contraindicated.

#### PROGNOSIS AND TREATMENT

The prognosis with regard to spontaneous closure of fistula of the uterus after cessation of menstruation at the menopause could not be determined from this series inasmuch as the ages of the patients made it inadvisable to delay operation until such time. It would appear that the outlook for closure could be fairly accurately predicted by the amount of discharge present during the intermenstrual periods and the tendency of the fistula to close at such times. Inasmuch as there is extensive inflammation, tuberculosis, or foreign body present in practically every case, spontaneous closure cannot be anticipated in the majority of cases and surgical interference is usually indicated.

The operative procedures consist of dissection of the fistulous tract and removal of any inflammatory tissue or foreign body that may be present. If the tract communicates with the uterus through either fallopian tube, salpingectomy should be performed and the opening into the uterus closed. If the fistula leads directly into the uterus, the intramural portion of the tract should also be removed and the opening into the uterus carefully closed. The round ligaments, or other tissue which are easily mobilized, may be utilized to cover the defect in the wall of the uterus. Absorbable suture material should be used throughout. In the presence of extensive inflammation involving the uterus hysterectomy may be necessary.

A fistula should not be considered surgically until at least six months have elapsed. During this time spontaneous closure may occur or, if the fistula persists, time is provided for the establishment of maximal local and general immunity to infection. Just before the menopause

surgical interference may be postponed in selected cases to permit possible spontaneous closure after the cessation of menstruation.

The patient's poor general health and the presence of multiple fistulas or complicating intestinal or urinary fistulas add to the risk of operation and should be considered before operation is decided on.

The operative mortality is low. In the series of cases discussed here, radical operation was performed in fifteen with no mortality. The factors contributing to safety in these cases are: (1) involvement of the pelvic peritoneum with its relatively high resistance to infection; (2) the fact that infection has usually been present long enough to establish maximal immunity, and (3) the fact that the type of infection present is usually of low virulence and tends to become chronic.

The results obtained following radical resection of the fistula and removal of inflammatory tissue are highly satisfactory. Complete and permanent closure was obtained in twelve of the fifteen cases. In one case there was still slight drainage when the patient was last heard from, three months after operation; one case was recent and in one case there was no record of the postoperative course.

Endometritis associated with open fistula is usually sufficient to prevent conception but subsequent to elimination of the fistula and the infection, conception may occur provided other pathologic processes or operative procedures are not sufficient to cause sterility. In this series of cases pregnancy did not occur in the presence of an open fistula. One patient became pregnant four times subsequent to elimination of the fistula; each pregnancy terminated in a normal delivery and there were no miscarriages.

#### SUMMARY

Fistula of the uterus is relatively infrequent as a postoperative complication. The diagnosis can be made almost entirely from the existence of a postoperative abdominal fistula which periodically discharges blood-tinged fluid coincident with menstruation. Operations in the presence of acute pelvic inflammation, abscess or tuberculosis, especially when they involve the incomplete removal of the inflammatory tissue, and the use of nonabsorbable suture material, are the outstanding causes of the formation of fistula of the uterus. Radical surgical removal of the fistulous tract, inflammatory tissue, and foreign bodies, when present, is usually indicated. This procedure is attended by a low mortality rate and good results.

#### REFERENCE

- (1) *Shaw, W. F.*: Jour. Obst. and Gynec. Brit. Emp., 1925, xxxii, 121-122.

## THE METABOLISM OF GALACTOSE\*

### IV. THE EFFECT ON THE TOLERANCE OF THE LEVEL OF OVARIAN ACTIVITY

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IN A PREVIOUS paper<sup>1</sup> one of us established as facts: (a) that in health there is a well-defined and limited tolerance in man for galactose, and (b) that there exists an intrinsic sex difference in the adult assimilation limit. In later papers dealing with the effect of disease on the tolerance<sup>2</sup> and summarizing the general results of the study,<sup>3</sup> we have touched upon the fact that the female assimilation limit shows variations which are seemingly determined by the several levels of ovarian activity.†

The status of the ovary during fetal, infantile, and prepubertal life may be regarded as qualitatively the same.

Under usual conditions, the next three decades or more see a rhythmic repetition of this act of ovulation, followed by corpus luteum formation, and subsequently by menstruation, determining a series of what are frequently termed false pregnancies. Only if the liberated ovum becomes impregnated does this rhythmic function cease, being supplanted by the equally characteristic sequence of pregnancy, parturition, and lactation. Coincident with the termination of the latter phase, or more frequently prior to its cessation, unless a new impregnation has taken place the menstrual rhythm is resumed. Naturally, the above connotes the existence of health and normality of function. Manifold disease conditions may interfere with the initiation or completion of any one of the several stadia. Under normal conditions, however, this rhythmic progression continues, possibly interrupted by pregnancies, for the period of active maturity.

The third and last phase is determined by the cessation of ovulation and its attendant phenomena, the so-called menopause which initiates the retrogressive changes of senility. The ovaries become fibrous in character with a disappearance of follicles of corpora lutea and in the senile organ, of the interstitial cells. Parallel changes occur in the genital tract and in the secondary sex characteristics.

Inevitably, in recent years these various modifications during the three major periods of life have been regarded as controlled and regu-

\*For lack of space certain portions of this article could not be printed, but the complete paper may be had in the authors' reprints.

†As has already been shown, the male tolerance in health remains unchanged throughout the life span and is unaltered by castration in adult years.



lated by internal secretory activities. In the ovary itself at different times, there are three potential sources in the follicle, the corpus luteum and the interstitial cells, while in the phase associated with reproduction, individual effects have been referred to the uterus, placenta, fetus, and mammary glands. Current thought is by no means unified as to the rôles played severally by each of these potential agencies, nor in fact is there agreement as to the endocrine character of all of them.

With this brief exposition we may now turn to a consideration of the influence of the apparent levels of ovarian activity upon the carbohydrate metabolism. The attention of the reader, in this connection is drawn to the fact that at certain phases of existence the mammary glands of the female presumably possess the power of synthesizing galactose from glucose (a stereoisomeric rearrangement), of conjugating the two sugars to form lactose, and of storing the product, and probably the intermediate materials.\*

#### METHODS

In general, the subjects of these studies were patients admitted to the diagnostic service of the Evans Memorial. During a residence of seven or more days they followed a schedule of intensive clinical and laboratory investigation which has been fully described elsewhere.<sup>10</sup>

It was thus possible to rule out other agencies which might influence the sugar tolerance. In addition, normal volunteers were accepted whenever they could be secured and given the same general study, but the enforced hospital stay was a serious deterrent in the adult groups. The sugar test was applied by the familiar technic with due observance of all necessary precautions.<sup>11</sup> The tolerance dose, as reported, is that amount which will excite a slight transitory melituria, while a test meal a few grams (usually 10) less in amount is negative. Weight deviations, as reported, are the means of the Dreyer<sup>12</sup> and West<sup>13</sup> comparisons, restricting the former to the prediction based upon sitting height.<sup>14</sup> Alveolar carbon dioxide tension was measured by the Fredericia method,<sup>15</sup> and the blood sugar by that of Folin-Wu.<sup>16</sup> The respiratory metabolism was determined by the closed circuit method, measuring the oxygen consumption by a Benedict-Collins<sup>17</sup> spirometer. Comparisons were made with the predictions both of the Harris-Benedict<sup>18</sup> and AubduBois<sup>19</sup> standards, and the mean reported.

#### PREPUBESCENT

But few references in the literature giving comparable observations are available. Schirokauer<sup>20</sup> reports some observations indicating a

\*This latter assumption is not essential but as the synthesis of galactose seemingly represents an intracellular activity, there must be a minimal concentration of the sugar constantly in the active glandular structures.

TABLE I. PREPUBESCENT

NO.	AGE (YR.)	WEIGHT DEV.	ALV. CO <sub>2</sub> (MM.)	BASAL RATE DEV.	BL. SUGAR (MG.)	GALACTOSE TOLERANCE	REMARKS
1	8	-16%	36	- 3%	81	20	Normal Control
2	9	-10%	49	-11%	105	20	Normal Control
3	9	-14%	36	+ 1%	86	20	Normal Control
4	9	- 5%	36	- 7%	91	20	Underdeveloped
5	10	-12%	40	- 2%	109	20	Normal Control
6	10	-13%	38	- 3%	80	20	Normal Control
7	10	-22%	39	-12%	101	20	Underdeveloped
8	11	-10%	36	-11%	110	20	Normal Control
9	11	+ 7%	39	-11%	100	20	Feeble-minded
10	11	+15%	40	- 6%	100	20	Normal Control
11	12	-12%	49	- 7%	100	20	Normal Control
12	12	-20%	38	-10%	104	20	Normal Control
13	12	-20%	42	- 2%	99	20	Normal Control
14	13	+ 5%	36	± 0%	77	20	Incipient Tuberculosis?
15	13	-20%	40	- 1%	110	20	Normal Control
16	14	-14%	36	-11%	109	20	Normal Control
17	14	-18%	34	+ 2%	98	20	Feeble-minded
18	14	- 5%	44	- 3%	87	20	Feeble-minded
19	16	-15%	32	+10%	110	20	Underdeveloped
Average		-11%	39	- 5%	99	20	

tolerance level at about 20 grams. Göppert<sup>21</sup> fixes the tolerance for children from two to four years old as about 15 grams.

The majority of our children were normal controls drawn from institutional sources. The data are collected in Table I.

But little comment is necessary. The group shows a definite tendency to underweight, only two of the children being above prediction. An examination of the Sitting Height Index shows an average value of 0.531. This is substantially normal and indicates an applicability of the Dreyer standards, though as these children did not have the mature female configuration, the underweight values represent maxima. So far as could be ascertained, this emaciation represented a normal habit; at least there had been no rapid loss of weight. In every case they were on a liberal controlled diet for at least four days before beginning the test. Finally, a partial inanition for carbohydrates would tend to raise rather than lower the assimilation limits. Six of the group showed basal rates on the lower borderline of normality. The standards at this age lack the clarity of definition which obtain with adults, and in no case was there other evidence of hypofunctional derangement. The uniform response of the group to a 20-gram test meal with equally uniform negative result with 10 grams, would seem to fix the prepubertal level at about this point.

#### PUBESCENT

The composing members of this group lack the sharp outline of the previous section. We have experienced the greatest difficulty in securing subjects at this interesting and important stadium of development.

Two of the children had not menstruated but both gave physical signs of a probable early onset.\* Case S-909 is included here although there is no real warrant for so doing. She was a girl of twenty-one years of mature feminine contour, who had never established the catamenia. Although she was undersized (4 feet 8 inches), her general picture was one of normalcy. The sitting height index was 0.528, a fully normal value, and the lung capacity was above prediction. The blood pressure was low (102/58). The urine picture was normal with the sole exception of a high (11.8 per cent) residual nitrogen fraction. Blood chemistry was strictly normal, and beyond a lymphocytosis of 45 per cent, the blood morphology was the same. The pelvic report is given verbatim: "The external genitalia are poorly developed; a sparse growth of hair is present. The hymen is intact. Rectal examination was made and pelvic parts were impossible to define. There was, however, poor cooperation on the part of the patient." With her tolerance threshold of 30, this patient could equally well be a pseudohermaphrodite with external female habitus and undescended testicles. The data are given in Table II.

TABLE II. PUBESCENT

CASE NO.	AGE (YR.)	MENST. AGE	WEIGHT DEV.	ALV. CO <sub>2</sub> (MM.)	BASAL RATE DEV.	BL. SUGAR (MG.)	GALACTOSE TOLERANCE	REMARKS
C-18	10	0 <sup>1</sup>	-10%	32	-12%	96	30	Deaf
B-400	12	12 mo.	+18%	43	- 2%	93	40	Congenital Hip Disease
B-382	13	6 mo.	-22%	38	- 7%	87	30	Congenital Leg Deformity
B-424	13	0 <sup>1</sup>	+28%	41	± 0%	87	30	Physiologic Obesity
B-622	13	6 mo.	-13%	42	-10%	88	30	Chorea
C-33	14	6 mo.	-22%	36	- 7%	91	30	Arthritis
S-909	21	0 <sup>2</sup>	+20%	39	+10%	105	30	Prematurity. Phys. Retard.

<sup>1</sup>Had not menstruated but all physical signs indicated speedy approach.

<sup>2</sup>See text.

Here again but little comment is necessary. The one child who had menstruated for a year had a tolerance of 40 grams. All of the others with a catemenial history of less than six months' duration were at 30 grams. At this period there must be a gradual transition to the mature state which seemingly is marked by a progressive upward trend of the assimilation limit. It would have been interesting to make a detailed study of this period but the poverty of available material has so far rendered this impossible.

\*One of them menstruated two months later. We have been unable to regain contact with the other.

TABLE III. MENSTRUAL INFLUENCE

CASE	AGE (YR.)	MENSTRUAL HISTORY		WEIGHT DEV.	R. M.	INTERMENSTRUAL PERIOD			GAL. TOL.	B. M.	MENSTRUAL PERIOD		
		ONSET	REG.	DUR.		CO <sub>2</sub>	BL. SUGAR	GAL. TOL.			CO <sub>2</sub>	BL. SUGAR	GAL. TOL.
Cr	37	12	Reg.	4 day	+42%	-1%	44	114	50	-2%	44	100	40
N	23	12	Reg.	4 day	-4%	-16%	35	93	40	-	39	100	35
MM	23	13	Reg.	4 day	-5%	-9%	42	97	40	-9%	45	98	30
MG	28	14	Irr.	5-6 day	-21%	+1%	40	116	40	±0%	38	97	30
S	25	14	Reg.	6 day	-16%	-10%	38	100	40	-10%	45	100	20
Cr	27	13	Reg.	5 day	-14%	-6%	38	87	30	-3%	37	103	30
G	21	13	Reg.	5 day	-9%	-5%	47	100	30	-9%	37	100	20
R	22	12	Reg.	4 day	+4%	-1%	39	97	30	-10%	42	95	20
No	22	12	Reg.	4 day	-11%	-11%	35	93	20	-7%	39	100	20
H	24	15	Reg.	4 day	-10%	-6%	45	91	20	-9%	45	100	20
F	30	13	Reg.	5 day	-10%	-5%	34	87	20	-15%	39	100	20
T	25	13	Reg.	5 day	-21%	-13%	39	100	20	-17%	39	95	20

## MATURITY

The level of tolerance of the adult female in a state of sexual rest has already been established at 40 grams.<sup>24</sup>

## MENSTRUATION

The effect of menstruation on the sugar tolerance has already been the subject of investigation. Okey and Robb<sup>25</sup> found no evidence of a cyclic variation in the level of blood sugar. They find a greater variability during the period than at any other time, though the average values are slightly higher. Using the Janney and Isaacson<sup>26</sup> technic, they secured blood-sugar curves (10 subjects) indicating a somewhat increased tolerance during menstruation. Küstner<sup>27</sup> notes a premenstrual glycosuria which is of short duration and which he ascribes to the presence of a functioning corpus luteum. His observation that the glycosuria of pregnancy disappears as confinement approaches, supports his thesis, but is in but poor agreement with the reports of numerous other observers. Hoffman,<sup>28</sup> using blood-sugar curves, notes that the tolerance for galactose (and for other sugars) is raised during menstruation. His statement that the tolerance limit for this sugar is probably 15 grams, naturally raises some question as to his other conclusions.

The study here reported was carried out with twelve volunteers. Several of them gave evidence of endocrine dysfunction and were purposely included. The galactose tolerance was determined in the middle of the interspace and again during the period. Adequate precautions were taken to prevent contamination of the latter collections. A variety of other measurements were made, some of which are reported.

The data presented show a number of interesting facts. In the first place, seven of the women showed a fall in tolerance (usually of 10 grams), while five exhibited no change. All of the latter had an initially low tolerance, four of them being at the prepubertal level while the fifth was intermediate. Those with the higher assimilation limits all showed a drop, as did two of the three at the slightly sub-normal level of 30 grams. This lack of agreement with the reports given above undoubtedly derives from the difference in methods employed. One of us has already shown the independability of the shape of the blood-sugar curve as a quantitative index.<sup>29</sup> From the figures given above it is safe to say that the assimilation limit for galactose usually is depressed during menstruation if the subject be initially above the minimum level observed in prepubertal years.

## MENOPAUSE

Coppioli,<sup>31</sup> in an article to which we have been unable to secure access, is quoted as finding a lowered tolerance for levulose in aged women.

TABLE IV. POSTMENOPAUSE

CASE NO.	AGE (YR.)	AGE	MENOPAUSE INTER.	WEIGHT DEV.	ALV. CO <sub>2</sub> (MM.)	BASAL RATE DEV.	BLOOD SUGAR (MG.)	GALACTOSE TOLERANCE	MARITAL HIST. PREG.	CHIL.	REMARKS
<i>a. Postmenopause—Married</i>											
B-729	45	35	10	+18%	42	-15%	105	40	1	0	Arthritis
B-700	46	37	9	-4%	42	-15%	91	30	1	0	Cardiorenal
B-422	48	43	5	-4%	-	-17%	100	30	4	3	Neurosis
B-1068	49	49	<1	+16%	41	-12%	100	30	2	2	Essential Hypertension
B-771	50	50	few months	+9%	46	-11%	97	30	3	3	Hypertension
B-461	51	43	8	+15%	43	+2%	94	30	3	2	Early Renal
B-645	51	50	1	+6.0%	41	-11%	125	40	3	3	Arthritis
B-239	52	51	1	+17%	34	-11%	97	40	4	4	Neurosis
B-386	53	53	<1	-6%	43	-9%	100	30	4	4	Psychoneurosis
B-173	53	50	3	-9%	-	-8%	104	30	2	2	Early Renal
B-541	53	43	10	+8%	37	-7%	94	30	3	3	Neurosis
B-345	53	39	14	+4%	35	-6%	114	30	1	1	Neurosis
B-200	55	39	16	+16%	29	-1%	68	30	4	3	Renal
B-617	56	53	3	+55%	42	-12%	118	30	15	10	Arthritis
B-500	58	52	6	+4%	(34)	-9%	91	30	4	4	Psoriasis
B-468	60	49	11	+13%	35	+3%	-	30	2	1	Arthritis
B-597	60	40	20	+5%	38	-2%	96	30	1	1	Eczema
B-357	62	50	12	-7%	42	+3%	93	40	6	4	Erythema multiforme
B-115	65	49	16	+14%	32	+2%	129(?)	30	1	1	Early Renal
S-395	70	50	20	-1%	29	-10%	103	40	2	2	Essential Hypertension
<i>b. Postmenopause—Unmarried</i>											
B-93	45	45	<1	+42%	38	-10%	86	30	-	-	Head Trauma
B-800	46	45	1	-14%	-	-2%	81	30	-	-	Neurosis
B-665	48	47	1	-22%	43	-3%	100	30	-	-	Pulmonary T. B.
B-360	48	44	4	+6%	42	-5%	92	30	-	-	Essential Hypertension
B-191	50	47	3	-19%	(28)	-2%	118	30	-	-	Neurosis
B-518	53	52	1	-7%	40	-14%	100	30	-	-	Nonspecific Lesion of Central Nerv.'s System
B-802	53	47	6	+2%	40	-6%	89	30	-	-	Essential Hypertension
B-365	55	46	9	-7%	44	-6%	97	40	-	-	Neurosis
B-368	55	46	9	+5%	38	-13%	92	30	-	-	Gout
B-114	61	45	19	-1%	44	+12%	92	30	-	-	Neurosis
B-763	61	50	14	+12%	43	-6%	100	30	-	-	Gastrointestinal Disorder

Stolper<sup>32</sup> found twenty-four women in a group of thirty-nine past the menopause who exhibited transitory glycosuria after the administration of 100 grams of glucose. Premenopausal controls were negative with this dosage. Beyond these meager records the literature seemingly contains no parallel observations. The data of this series are given in Table IV.

The general tendency is downward, but only to a point midway between the mature and prepubertal levels. Several of the patients show an unchanged tolerance that in no instance can be referred to serious impairment of kidney function. That the kidney may show a lessened permeability in advanced nephritis, has been commented on elsewhere (Rowe, l.c.).

#### CASTRATION

Di Fillippi,<sup>33</sup> using bitches, and more recently Tsurbura,<sup>34</sup> with rabbits, have noted a fall in sugar tolerance after castration. Artom<sup>35</sup> finds opposite results, using bitches and invert sugar. M. Parhon,<sup>36</sup> notes that the glycogen content of the liver and muscles of castrated animals falls far below that of the intact. We have found but one directly comparable record in the paper by Stolper already cited. This author reports a group of women negative to 100 grams of glucose before operation and usually positive after castration (16 positive in 19 cases and two others with a polyuria which rendered the tests indeterminate). He notes that partial castration also tends to lower tolerance. The data from our series of castrated women are collected in Table V.

The data given in Table V leaves but little doubt as to the effect of castration on the galactose tolerance. With but two exceptions, all exhibit the prepubertal level of 20 grams. One of the exceptions, a woman of forty-three, had been castrated twenty-two years before. The possibility of an incomplete operation cannot be excluded. The other case showing a normal postmenopausal level was that of a woman of sixty-four years who had been castrated less than a year before. To balance this, Case S-1074, who was four years older and had also been operated upon a year earlier, showed the characteristic level. The usual influence on the basal rate is apparent. The nervousness that is characteristic of the gonad failure from whatever cause is manifest in the few cases showing normal values, and lack of basality was noted at the time of the test. A downward trend to the alveolar carbon dioxide is apparent, but equally it falls short of that shown in pregnancy.

#### CASTRATES WITH OTHER ENDOCRINOPATHY

While a depression of ovarian function either through ablation or, as will be discussed later, through disease, produces a lowering effect on the carbohydrate assimilation limit, other endocrine glands also play a

TABLE V. CASTRATES

CASE NO.	AGE (YR.)	CASTRATION AGE	INTERNAL COND.	MARITAL PREG.	WEIGHT DEV.	ALV. CO <sub>2</sub> (MM.)	BASAL RATE DEV.	BLOOD SUGAR (MG.)	GALACTOSE TOLERANCE	REMARKS
S-147	24	23	1	U	- 13%	26	(+9%)	100	glycos.	B.M. too high <sup>1</sup>
S-148	33	26	7	U	+ 4%	30	-10%	90	20	
S-329	38	37	1	U	- 14%	28	- 3%	105	20	
B-222	39	37	2	U	- 11%	29	(-2%)	100	20	B.M. too high <sup>1</sup>
S-197	42	38	4	U	+ 14%	35	-17%	91	20	
B-336	43	21	22	U	- 2%	38	-19%	103	30	
B-706	48	46	2	M	+ 12%	42	-15%	88	20	
S-606	48	35	13	M	+ 74%	41	-11%	113	glycos.	
S-1568	49	23	26	M	+ 21%	38	-23%	87	20	Married after op.
S-451	50	34	16	M	+ 8%	39	- 9%	95	glycos.	
S-423	50	36	14	U	+ 0%	39	-11%	100	glycos.	
B-664	51	44	7	M	- 5%	44	+ 5%	80	20	Many abortions
B-396	51	35	16	M	- 33%	38	-14%	81	20	
B-50	51	23	28	M	+107%	36	-17%	113	20	
B-176	52	48	4	M	+ 4%	24	(+4%)	97	glycos.	B.M. too high <sup>1</sup>
S-913	58	53	5	U	- 1%	39	- 9%	100	20	
B-483	58	38	20	U	- 13%	39	- 9%	84	20	
S-261	59	42	17	M	+ 18%	34	-15%	91	20	
B-537	64	63	<1	M	+ 7%	36	- 9%	100	30	
S-1074	68	67	1	U	- 6%	40	-21%	84	20	
Ga	22	22	few days	M	-	-	-	91	30	
An	26	26	"	M	- 31%	32	- 5%	100	30	
Pi	36	36	"	M	- 7%	40	-12%	118	30	

<sup>1</sup> Patient nervous and restless. Test not basal.



TABLE VI. PLURIGLANDULAR INFLUENCE

CASE NO.	B-2	S-744	S-1327	S-1343	B-659	B-109	B-599	B-662
Gland	P-	P-	P-	P-	P-	T-	T-	T-
Age (yr.)	45	45	35	48	65	50	54	41
Age of Castration	29	39	32	42	52	32	20	30
Interval	16	6	3	6	13	18	34	11
Condition	M	M	M	M	M	M	M	M
Pregnancies	5	8	1	2	0 <sup>2</sup>	3	0 <sup>1</sup>	13
Weight Dev.	-	12%	-5%	-1%	-52%	-14%	+31%	-8%
Alv. CO <sub>2</sub> (mm.)	-	34	37	44	43	32	40	42
Basal Rate Dev.	-	-23%	-10%	(-7%) <sup>3</sup>	-20%	-30%	-21%	-25%
Blood Sugar	-	87	118	100	83	68	87	88
Galactose Tolerance	50	30	40	40	60	20	30	30
Deviation	+150%	+50%	+100%	+100%	+200%	±0%	+50%	+50%

<sup>1</sup>Married after castration.<sup>2</sup>Separated shortly after marriage.<sup>3</sup>Not basal. Patient nervous.

part in the regulation of sugar metabolism. A few so-called pluriglandular cases have been selected from the series to illustrate the double effect. It will be understood that the polyglandular character of these cases rests upon an independent endocrinopathy superimposed upon that produced by castration. The pluriglandular syndrome of purely functional origin is a condition of utmost rarity, if, indeed, it exists at all. The data of a few typical cases are shown in Table VI.

Castration produces a normal tolerance of 20 grams. In the five pituitary failures (posterior lobe), the average increase is +120 per cent, with one case showing a tolerance 200 per cent above the normal castrate level. The three thyroid cases, on the other hand, show an average of +33 per cent. These relative values are in conformity with those derived from long series of cases presenting uncomplicated pituitary and thyroid failures. The effect is patently an additive one.

The influence of functional failures of the ovaries on the assimilation limit will shortly be discussed at length elsewhere by one of us (Rowe). It is sufficient to say here that in 200 cases of functional hypogonadism in adult females, 160 showed a tolerance threshold of 20 grams, while the 40 remaining cases were positive with 30 grams. Four additional cases, showing levels less than 20 grams were severally syphilis (2), liver disease (1), and brain tumor (1); all conditions that have been shown to lower sugar tolerance. Severe functional failure, then, duplicates the influence of castration on the power to utilize galactose, while less severe functional disturbances show a trend which differs only in degree.

It will be noted first that in this discussion the highly important stadia of pregnancy and lactation have been omitted. In them the mammary glands play a part in the carbohydrate metabolism sharply differentiated from the several phases (with the possible exception of menstruation) discussed here. These questions are to be considered in a subsequent paper. In Table VII several relationships are schematically presented. From the standpoint of the Frank theory, the

TABLE VII. GENERAL RELATIONSHIPS

STADIUM	SUGAR TOL.	ENDOCRINE AGENT			STORAGE CAPACITY OF BREASTS
		FOLL. HOR.	COR. LUT.	INT. CELLS	
Prepubescence	Low	0	0	+	Low
Pubescence	Increase	+	+	+	Increase
Maturity	High	+	+	+	High
Menopause	Decrease	0	0	+ to 0	Decrease
Menstruation	High	} late 0 early +	} early 0 late +	+	High
Interspace					
Period	Decrease	0	+	+	Increase ?
Castration	Decrease	0	0	0	Decrease
Function Failure	Decrease	+	+	+	? (probably decrease)
Breast Ablation	Decrease	+	+	+	None

follicular hormone and that of the corpus luteum are identical, and but one column would be necessary. As other observers have recorded active extracts from the corpus, the method adopted is to be preferred.

Summarizing, we find that with the sole exception of the anomalous relationship during the menstrual period, the fluctuations of the sugar tolerance follow qualitatively those of the storage capacity of the breasts, either demonstrated or assumed.

Assuming then that the sugar tolerance is determined qualitatively by the mammary glands, we inevitably reach the conclusion that this is but a secondary or resultant phenomenon. It will be generally conceded that hormonal influences regulate the growth changes in the breasts. Further, an exact quantitative relationship between breast capacity and sugar tolerance is lacking, as the breast changes in the menopause and subsequent to castration do not parallel the two definitely different tolerances observed in the two states. Further, castration produces the prepubertal tolerance but not the mammary glands of childhood.

Delimiting conclusions to the warrantable, the results may be summarized as follows:

#### SUMMARY

1. The human female, in health, has a series of definite assimilation limits for galactose, the fluctuations of which are seemingly associated with changes of physiologic activity of ovarian function.

2. Starting at a low level in prepubertal years, with the onset of puberty the tolerance rises to a level in maturity double the first, and maintains this until the cessation of the catamenia is accompanied by a recession of moderate degree.

3. To those whose level is superior to the prepubertal, the act of menstruation usually determines a slight depression in the tolerance.

4. Castration of the adult lowers the sugar tolerance to the prepubertal level, and functional failure exhibits the same tendency, the degree of the depression correlating with the severity of the impairment.

5. The mammary glands are shown to have an important but apparently secondary influence in determining assimilation limits.

6. The menstrual relationships constitute a possible exception, but presumably are more closely associated with the events of the reproductive cycle, which are not considered in this paper.

7. In the main, the results of the study are in harmony with Frank's observations and his theory of the female sex hormone. Equally, the results could be explained by other endocrine formulas wholly independent of the foregoing.

8. The interstitial glands, at least during adult years, seemingly have only a secondary influence, if any, on the regulation of galactose tolerance.

9. The reproductive phase is to be considered independently in a subsequent paper.

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## A CASE OF ABDOMINAL PREGNANCY REMOVED PER VAGINAM

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ALTHOUGH there are a large number of abdominal pregnancies recorded in the literature, the condition is rare enough to still warrant publication of all cases. In addition this case is of interest from the standpoint of treatment.

Discussion of treatment in the past has had to do almost entirely with the method of dealing with the placenta. Three courses of action are possible: separation and removal, marsupialization, and leaving the placenta in situ with or without drainage.

In this connection Beck, in 1919, showed that the mortality was lower without drainage than with it, where the placenta had been left, the drainage in question being abdominal. Beck stated that it was a valued procedure of the Italians about 1895. Le Doux<sup>1</sup> has recently reported two cases of full-term abdominal pregnancies in which the placenta was left in the abdomen. The first one was packed and drained and the patient died on the sixteenth day with general peritonitis. The other case he closed without drainage and the patient died in a few hours from internal hemorrhage. He points out that drainage through the culdesac would seem logical and desirable. In the discussion that followed, Salatich mentioned a case where they had endeavored to extract the child by colpotomy. Both mother and child were lost and the operation was very difficult and unsatisfactory. J. A. Knock<sup>2</sup> reported a case of abdominal pregnancy a month past term with infection of the sac. The patient's condition was poor, with a temperature of 102°, a pulse of 120 and some jaundice. He plugged the sac after laparotomy and then sewed the edges to the abdominal wound and the patient recovered.

In cases where the child is still alive or where the sac is not infected the abdominal route is undoubtedly the one of choice, though the method of dealing with the placenta is always going to be a difficult problem if its attachment is such as to lead to severe hemorrhage when removed. In view of the case which I am about to report it might be suggested that removal of the child, leaving the placenta in situ and draining *per vaginam* are worthy of a trial. When one comes to deal with an abdominal pregnancy in which the sac has become infected a different problem arises. The patient is septic and her general condition is poor. Dense adhesions wall off the gestation sac from the general peritoneal cavity and to dissect down to the fetus is often a difficult task. Moreover, once that dissection is made the whole peritoneal cavity is contaminated with pus and if the placenta cannot be removed prolonged drainage is necessary. In cases of doubt regarding the differential diagnosis of ectopic and inflammatory disease most of us resort to puncture of the rectovaginal pouch because of

the danger of opening the abdomen in the presence of pus. How much more dangerous must it be with an affected abdominal pregnancy. It was these considerations that led me to operate by the vaginal route in my case.

I have found three other cases in the literature in which the fetus was successfully removed by incision of the vagina. Two of these are reported in the same journal, *Le Bull. et Memoires de la Societe Obstetricale et Gynecologique de Paris*, 1893-94. The first case was reported by Guerison. The pregnancy was at term and the child dead. He perforated and crushed the skull and then delivered. The placenta was left and drainage carried out *per vaginam*. He states that he chose his method because the head was so low in the pelvis and the child was dead. The other case was reported by Touenaint. The fetus was one of only five months' development, but it had been carried for years as a lithopedion. He extracted through an incision in the posterior culdesac. The only other case I have found was reported by C. G. Davis.<sup>3</sup> The child died one week before term and operation was done five months later. He removed the placenta in bits and packed the cavity. A small fecal fistula appeared on the tenth day but healed.

The following is the history of a personal case:

Mrs. S., aged twenty-six, four previous pregnancies, normal. Patient seen on November 27, 1925. Last menstruation began on February 10, 1925, and was normal except that it was accompanied with more colicky pain than usual. A month later there was a slight show one day but no pain; otherwise the pregnancy appeared to advance normally until September 15, at which time she rolled over a low fence and a few minutes later collapsed. When seen by her physician her temperature was subnormal, her pulse 140 and a diagnosis of concealed accidental hemorrhage was made. She slowly recovered and two weeks later was running a slight temperature which was never above 100°. There was no evidence of fetal life after the collapse. When the patient reached her expected date and did not go into labor, three attempts at induction were made, but without success and she was then sent to the city. On examination she was pale and slightly jaundiced with a temperature of 103° and a pulse of 120. Her abdomen was the size of a seven months' pregnancy, but the fetal parts were not well defined and a tympanitic note was obtained over the abdomen. On bimanual examination the cervix was small, firm and pressed up against the pubes. Behind the cervix a large, tender, cystic swelling was bulging out the posterior fornix and the wall of the vagina. The fetal head could be felt behind the uterus. On December 2 a T-shaped incision was made in the vault of the vagina and the pus evacuated. The fetal head was then perforated and crushed. Considerable difficulty was encountered in the delivery of the anterior shoulder, but the child was eventually extracted. On exploring the cavity the placenta was found to form part of the abscess wall and any attempt at removal appeared ill advised. Accordingly the cord was severed at the placenta and a large drainage tube left in the colpotomy opening. On December 19 the patient returned home with the drainage tube still in position where it remained until January 19. Discharge had then practically ceased and the tube was removed. The patient menstruated on February

9, the flow being profuse. She also flowed more than normal in March but since then menstruation has been normal. She had gained thirty-seven pounds by the fourteenth of April and has been in good health since.

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## TUBERCULOUS SALPINGITIS

A REPORT OF CASES TREATED AT THE FREE HOSPITAL FOR WOMEN,  
BOSTON, BETWEEN 1896 AND 1927

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THE following report of 63 cases of tuberculous salpingitis covers the thirty year period from October, 1896, to January, 1927, and includes all patients who had tubal tuberculosis, whether the process was localized in one or both tubes or whether the tubal process was but part of a general pelvic or abdominal tuberculosis. In but 34 instances (53.96 per cent) was tuberculous salpingitis found alone. During this same period about 13,000 abdominal operations were performed. The finding of tuberculosis in but 0.48 per cent of laparotomies and in 2.26 per cent of all tubal inflammation in a gynecologic clinic establishes this manifestation of the disease as a comparatively rare occurrence. Others have found higher percentages of tuberculosis in tubal inflammations; e.g., Williams, 7 per cent; Findley, 10 per cent; Menge and von Rosthorn, 6.2 per cent, and Penrose, 18 per cent. In every case of our series the diagnosis was made or confirmed by microscopic examination.

*Age Incidence.*—The youngest patient in this series was sixteen; the oldest forty-six. There were 3 patients under twenty years of age, 14 between twenty and twenty-five, 22 between twenty-five and thirty, 11 between thirty and thirty-five, 9 between thirty-five and forty, and 4 between forty and forty-six.

*Marital History.*—Eight patients were unmarried; 55 were married. Five gave a history of spontaneous abortion, 5 had had one child, 4 had had two children, and 5 had had three or more children. A history of never having been pregnant was given by 35 married patients (55.5 per cent of the whole series and 64.8 per cent of the married patients). The percentage of sterility among women in general is usually calculated to be between 10 and 16 per cent.

*Family and Past History.*—A family history of tuberculosis was given by 7 patients, of malignancy by 3. A past history of pulmonary

tuberculosis was given by 2; coughing blood by 1; pleuritis by 7; of excision of glands of the neck by 2; operation for tuberculosis of the kidney by 1; typhoid fever by 7; influenza, 2; scarlet fever, 1; rheumatic fever, 3; erysipelas, 1; malaria, 2; breast abscess, 1; and "ulcers of stomach," 2. Four had had previous appendectomy, 4 had had tonsillectomy, and 6 had had dilatation and curettage.

*Complaints.*—"Pain in lower part of stomach," 42; "backache," 23; "desires children," 9; "burning on urination," 8; "swelling of stomach," 8; "painful periods," 8; "pus in urine," 7; "passes water at night," 6; "weakness," 6; "discharge from front passage," 5; "vomiting," 5; "painful urination," 4; "blood in urine," 4; "passes water often," 3; "irregular periods," 3; "falling of womb," 3; "loss of weight," 3; "fever," 3; "profuse periods," 3; "soreness in rectum," 2; "headache," 2; "pain through bowels," 1; "abscess outside of rectum," 1; "vomits blood," 1; "bearing down," 1; "pressure in pelvis," 1, and "painful intercourse," 1.

Each patient made one or more of the above complaints. In 3 of the 42 instances of abdominal pain the pain came in occasional, severe, sharp attacks while in the others it was constant, both dull and sharp and most often exaggerated before and during menstruation. In two cases menstruation relieved the pain. The duration of symptoms varied over an extreme range, from two weeks to eighteen years, most commonly from one to three years. Except for three complaints of loss of weight, three of fever, and one of vomiting blood, there were no symptoms that pointed toward lung involvement.

*Menstruation.*—Negative, 14; acquired dysmenorrhea, 28; acquired dysmenorrhea and metrorrhagia, 5; acquired dysmenorrhea and menorrhagia, 1; catamenia rare, scant, and painful, 1; pain just before, but relieved at start of catamenia, 1; pain after catamenia, 1; metrorrhagia, 6; menorrhagia and metrorrhagia, 2; catamenia began at age of nineteen, 1; oligomenorrhea, 2; abnormally early menopause (at nineteen and thirty-two), 2.

*Other Tuberculous Findings.*—Thirty-four patients showed no tuberculosis except that of the fallopian tubes. Of the others lung signs were present in 12 (19.04 per cent); the peritoneum was involved in 16, the ovary in 15, the endometrium in 14, the omentum in 3, and the mesenteric glands in 1. Ascites was present in 8 of those with peritoneal tuberculosis. Tuberculous pelvic abscess was found at operation, or developed after operation in 8 patients. One patient had tuberculosis of the urinary bladder at the time of operation; one had a fistula in ano. In 5 instances a tuberculous sinus was present or developed in the abdominal wound after operation, and closed from two months to one year later, resuture being necessary in three cases. Four years, six months after operation one patient was reported to have a fecal fistula in which no tuberculosis could be found.

*Associated Pathology.*—There were no peritoneal adhesions in 23 cases; i.e., tubes, ovaries and all pelvic and abdominal structures were free. The adhesions in the other 40 cases varied greatly from those that were described as tenuous, or fibrinous to the dense, diffuse, fibrous type. In 2 patients, both unmarried, the cervix protruded from the vulva in the form of a procidentia due apparently to poorly developed pelvic tissues. Fibroids were found at operation in 7 cases, an endometrial polyp in 1, hyperplasia of the endometrium in 6, adenomyoma of the uterine cornua in 1, and papillary serous cystadenoma of the ovary in 2.

*Operative Procedures.*—Five patients received no operative treatment beyond exploration and biopsy, the disease being widespread. Thirty hysterectomies (with bilateral salpingo-oophorectomy) were performed; two were complete, and the others supravaginal. In six cases both tubes and both ovaries were removed without hysterectomy. Various conservative operations were done in 22 instances. Of those patients treated conservatively, not one is known to have become pregnant at a later date. There were two operative deaths (3.17 per cent), from peritonitis and shock respectively.

#### RESULTS

Fourteen patients are untraceable.

*Exploratory coeliotomy and biopsy*, 5 cases. One patient is untraceable, one died of pulmonary tuberculosis one year, three months after operation, one was operated on again six years, eleven months after discharge, and is now well, ten years after her first operation; another patient has some pain in her abdomen, some flowing and discharge, but feels "pretty well" eleven years after operation. The fifth patient is alive ten years after operation.

*Primary hysterectomy with bilateral salpingo-oophorectomy*, 30 cases. Untraceable, 6. There was one postoperative death from surgical shock. Three died at three, four and one-half, and eleven months after operation of pulmonary, miliary, and generalized tuberculosis, respectively. One patient died two years, ten months after operation of "tuberculous complications." Another died three years, seven months after operation of "carcinoma of left ovary" (probably tuberculous abscess). A fifth patient died seven years after operation of "rheumatic heart disease," and the sixth was well except for slight flowing two years after operation, and died of "lobar pneumonia" ten years, six months after operation. There were well less than one year after operation, 6, and between one and two years after operation, 2. One patient complained of discharge and pain two years after operation. Six patients were well at three years, four years, six months, seven years, twelve and one-half years, fourteen years, and sixteen years



after operation, respectively. One patient was well except for a fecal fistula, in which no tuberculosis could be found, four years, five months, after operation.

*Bilateral salpingo-oophorectomy*, 6 cases. One operative death from peritonitis (1897). One patient, who had had "inflammation of the stomach and bowels" for eight years, "peritonitis" for four years, and "abscess of the colon" for one year, underwent supravaginal hysterectomy six months after removal of tubes and ovaries, had a pelvic abscess evacuated two years, three months later, and died two years, ten months later. The third patient had a mass in her pelvis one year, two months after operation, but was well four years after operation. Another patient continued to menstruate after operation (some ovary must have been left in) and complained of some lower abdominal pain which was better during menstruation, twenty-three years after operation. Her chief complaint was of persistent hot flushes. The fifth patient, with tuberculous peritonitis and ascites at the time of operation, was well nine months after operation. The sixth patient was well thirty-one years after operation.

*Conservative operations*, 22. Untraceable, 8. Two patients whose tubes were not considered badly damaged enough for resection or excision (biopsy was performed) were well five years after operation.

The following are brief outlines of the 12 other traceable cases.

1. One tube and ovary and part of other tube excised. Patient complained of irregular menstruation, pain in lower abdomen and much vaginal discharge seventeen years, five months postoperative.

2. Both tubes and one ovary excised. Supravaginal hysterectomy was performed three years, five months later. Patient was well seven years, ten months after operation, but died of pelvic abscess eleven years after operation.

3. One tube and ovary and part of other tube excised. Patient was well two years, eight months after operation.

4. One tube excised—bad, diffuse adhesions. Patient was operated on for acute intestinal obstruction one year, two months after operation and was doing fairly well four months afterward.

5. One tube excised. A small mass was present in the left lower quadrant three years, ten months after operation.

6. Resection of both tubes and one ovary. The patient was well three years, eight months later.

7. One tube resected and some adhesions broken up. Patient died twenty years later of "bronchial asthma."

8. Both tubes excised. Patient died sixteen years, seven months after operation of "bronchopneumonia."

9. Left salpingo-oophorectomy. Patient was well four years after operation.

10. Both tubes resected. Patient was well two years after operation.

11. Both tubes excised and a piece of ovary implanted in one uterine cornu. Patient was well nine years, seven months after operation.

12. Complaint was dysmenorrhea. Lysis of adhesions and bilateral salpingectomy. Patient not relieved. Operated on again sixteen years after first operation and now is well twenty-two years, five months afterward except for slight menorrhagia.

## SUMMARY AND CONCLUSIONS

1. The finding of tuberculous salpingitis, either alone or in association with pelvic, abdominal, or thoracic tuberculosis, in less than one-half of one per cent of patients undergoing laparotomy in a gynecologic clinic, and in 2.26 per cent of all tubal inflammation, demonstrates the comparative infrequency of the disease.

2. The disease makes itself known almost exclusively in the third and fourth decades, its highest incidence being in women between the ages of twenty-five and thirty.

3. The percentage of sterility in this series is 64.8, as against a 10 to 16 percentage among women in general.

4. A family or past history of tuberculosis, or suggesting it, was given by 20 per cent of patients.

5. The patients' complaints afforded no definite clue toward making a preoperative diagnosis.

6. The duration of symptoms varied from two weeks to eighteen years.

7. There were no menstrual complaints in 22.2 per cent of patients. In 53.9 per cent acquired dysmenorrhea was present.

8. Physical signs of possible pulmonary involvement were found in 19.04 per cent of this series, although there were only 7 complaints that could be interpreted as indicating lung disease, and these were not chief complaints. Five, however, of those who had lung signs at the time of operation were well from ten to twenty-three years after operation. (One of these died of "bronchial asthma" twenty years after operation.)

9. Eleven patients, 17.4 per cent of the series, are known to have died of probable tuberculosis. Five of these 11, 7.9 per cent of the total, died of probable pulmonary tuberculosis. Only two showed pulmonary signs at the time of operation.

10. In only 53.9 per cent of cases was the disease apparently localized in one or both fallopian tubes.

11. The primary operative mortality was 3.17 per cent. Operation was probably a contributory cause of death in at least 2 other instances.

12. No later pregnancy is known to have occurred in any of these patients.

13. It is difficult to draw definite conclusions concerning treatment and its results, for some patients who, because of the extent of the disease, were only explored, or submitted of necessity, to conservative operation, were well for long periods. On the other hand, conservative operation on early or moderately severe cases did not give satisfactory results. The best long-time results were achieved by radical operation, in cases where the disease was fairly advanced but not beyond operative measures. This may have been purely coincidental.

Although operation is necessary for making a diagnosis and is undoubtedly an important part of treatment in that it removes diseased tissue, its place in relation to general health measures, such as rest, diet, and light, cannot be stated definitely, because data as to the actual living conditions of these patients have not been available.

FREE HOSPITAL FOR WOMEN.

## THE OFFICE USE OF THE ELECTRIC CAUTERY IN GYNECOLOGY

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SO VALUABLE is the electric cauter in the treatment of various gynecologic conditions, that it does not seem out of place to call it again to the attention of the medical profession. Hunner,<sup>1</sup> in 1906, was the first to advocate this form of treatment, finding it especially valuable in cases of endocervicitis with erosion. Hunner, however, used the Paquelin cauter and found it necessary in many cases to use an anesthetic. Dickinson,<sup>2</sup> in 1921, pointed out the superiority of the small nasal cauter tip, stating that this form of treatment can be applied in the office without anesthesia. In 1926 Shutter<sup>3</sup> concluded that the electric cauter is the best form of treatment in gonorrheal endocervicitis. In the same year Noyes and Corvese,<sup>4</sup> and Matthews<sup>5</sup> separately advocated its use in treating moderate cervical lacerations, especially where erosion coexists, reserving the Sturmdorf operation for the severe cases.

The material reported here is derived from 116 cases treated by this method in our office during the last three years. The pathology encountered in these cases was:

1. Cervical laceration and erosion (nonspecific endocervicitis)	30 cases
a. Plus retroversion	10 cases
b. Plus pelvic relaxation	6 cases
c. Plus general debility	5 cases
d. Plus fibroid uterus	5 cases
e. Plus chronic pelvic inflammation	3 cases
f. Plus chronic vaginitis	2 cases
g. Plus prolapse	1 case
h. Found on postpartum examination	15 cases
i. Following hysterectomy	1 case
j. Following amputation of cervix	1 case
Total nonspecific endocervicitis and laceration	79 cases
2. Chronic gonorrheal endocervicitis	16 cases
3. Nabothian cysts of cervix	13 cases
4. Gonorrheal infection of Skene's ducts	6 cases
5. Urethral caruncle	2 cases
Total number of cases treated	116 cases

Thus there were 79 cases of cervical laceration and nonspecific endocervicitis. The method of treatment was essentially that described by Dickinson.<sup>2</sup>

These cases may be divided into four groups so far as the size of the laceration and erosion is concerned: (1) no definite laceration but erosion present; (2) slight to moderate laceration with erosion, the exposed erosive area being approximately the size of a dime; (3) moderate to fairly deep laceration with erosion approximately the size of a quarter; (4) deep laceration and marked eversion and erosion.

Of the total number of 79 cases treated only 70 are available for study as 9 did not return to the office after the first treatment. Twenty-five of these fell into the first group, of which 19 (76 per cent) received one treatment, 5 (20 per cent) received two treatments and in one case three treatments were necessary. Twenty patients (80 per cent) were completely relieved of all leucorrhea and on inspection the cervix appeared to be in good condition. These patients were classified as cured. In 5 patients (20 per cent) there was either a slight persistent mucoid leucorrhea, or at the time of the last examination a small area of erosion still remained. These patients were therefore classified as improved. There were no patients in this group who were not materially helped. In the second group there were 37 cases available for study. Twenty-six (70 per cent) received one treatment and 11 (30 per cent) received two treatments. There were 31 patients (84 per cent) cured, 6 (15 per cent) improved, and no failures. Of the 6 cases falling in the third group, 2 (33 per cent) received one treatment, 2 (33 per cent) received two treatments, and 2 (33 per cent) received three treatments. Two patients (33 per cent) were cured while 4 (67 per cent) were improved. There were no failures in this group. In the last group there were only 2 cases on whom this form of treatment was tried. One received one treatment and was cured, while the other was only slightly improved after two treatments. This data is shown in Table I.

TABLE I

GROUP	NO. CASES	NO. TREATMENTS			CURED		IMPROVED	
		1	2	3	NO.	PER CENT	NO.	PER CENT
I.	25	19	5	2	20	80	5	20
II.	37	26	11	—	31	84	6	16
III.	6	2	2	2	2	33	4	67
IV.	2	1	1	—	1	50	(1) 1	50
Total	70	48	19	4	54	77	16	23

There were 16 patients suffering from chronic gonorrheal endocervicitis. Positive smears were obtained in all cases before treatment was started. Patients were considered as cured only when all signs and symptoms had disappeared and three successive smears were

negative for gonococci. Seven cases (44 per cent) received two treatments and 2 (12 per cent) received three treatments. Ten patients (67 per cent) were discharged as cured. Three patients (20 per cent) were symptomless and had negative smears at the time of the last examination but did not return for corroborative smears and were therefore classed as improved. Two patients (13 per cent) still had positive smears at the time of the last examination and did not return for further treatment. These cases must necessarily be classed as failures. The average length of time between the first treatment and the last examination was nine weeks for the cured cases, nine weeks for the improved cases, and fifteen weeks for the failures. Table II shows this data.

TABLE II

	NO. OF TREATMENTS			CURED		IMPROVED		FAILED	
	1	2	3	NO.	%	NO.	%	NO.	%
No. of cases	7	7	2	10	67	3	20	2	13
Length of treatment				9 weeks		9 weeks		15 weeks	

Nabothian cysts of the cervix are well treated by the electric cautery. The method consists in using a fine pointed cautery loop (Wappler light cautery electrode No. 2). The loop is heated to a white heat and the cystic area punctured and thoroughly cauterized. Where more than one cyst exists, each cyst is treated separately. There were 13 cases treated in this manner. Of these only 10 are available for study as 3 did not return for follow up examination. Of the 10 who did return, all were cured by one treatment.

It has been customary to treat gonorrheal infections of Skene's ducts by injection of silver nitrate, the cautery being reserved for obstinate cases. However, the results have been so uniformly good in all cases treated by the latter method that it is regarded with more and more favor. Against it is the fact that it necessitates local anesthesia. The pointed cautery tip is placed in the duct and held in place by an assistant. The tissue surrounding the duct is then infiltrated with novocaine. If the infiltration is carried out first, difficulty is sometimes experienced in locating the duct opening. The cautery point is then pushed to the bottom of the duct and the current turned on. The heat should be applied for from four to five seconds. If difficulty is experienced in withdrawing the cautery, this can be overcome by again turning on the current while the tip is quickly withdrawn. Six cases have been treated in this manner. In 4 the discharge and positive slides disappeared after the first treatment. The other 2 cases are still under observation, the treatment having been carried out so recently that no definite information is as yet obtainable.

In treating urethral caruncle the curved cautery tip is used. The

caruncle is anesthetized by either novocaine injection or the application of a cocaine crystal. Minute linear cautery lines are then burned in the caruncle in a manner similar to the eroded cervix. Two cases have been treated with excellent results following one application of the cautery.

In all instances where the cautery is used the patient should be warned that the leucorrhea will be temporarily increased. A daily cleansing douche of sodium bicarbonate has been found soothing and healing and should be prescribed while the treatment is being carried out. That anesthesia is not necessary when the cautery is applied to the cervix is shown by the fact that in no instances was it necessary to stop treatment because of pain. By far the majority complained of no discomfort at all while a few complained of a cramp-like pain in the lower abdomen during and a few seconds following the treatment. It has been found that should this pain occur it can to a great extent be obviated by allowing the cervical tissues to cool before continuing the cauterization.

Objection to this form of treatment has occasionally arisen because of the possibility of hemorrhage. In this series there were 4 patients who stated that the leucorrhea was slightly blood tinged. In 1 case this condition was reported to have lasted for three weeks. In no instance could the bleeding be termed dangerous. Occasionally a temporary mild menorrhagia will appear following cautery treatment of the cervix. In this series notes were made as to the effect on the following menstrual periods in 86 instances. Of these, 81 (94 per cent) had no disturbance. In 3 cases (3.6 per cent) there was a moderate menorrhagia for one period while in 2 cases (2.4 per cent) the increased bleeding occurred for two and three months respectively.

#### SUMMARY

It is felt that the electric cautery offers a most satisfactory method of treating the milder types of cervical laceration and erosion in the office. In the more severe types, while the results are not so uniform, it is worthy of a trial before resorting to operation, especially if the woman be in the child-bearing period. It is probably the treatment of choice in chronic gonorrheal endocervicitis, gonorrheal infection of Skene's ducts, and the office treatment of urethral caruncle. The procedure is apparently harmless and so far as could be ascertained from this series without troublesome sequelae.

#### REFERENCES

- (1) *Hunner, Guy L.*: Jour. Am. Med. Assn., 1906, xlv, 191. (2) *Dickinson, R. L.*: AM. JOUR. OBST. AND GYNEC., 1921, ii, 600. (3) *Shutter, H. W.*: Surg. Gynec. Obst., 1925, xl, 572. (4) *Noyes, I. H., and Corvers, Anthony*: Rhode Island Med. Jour., 1926, ix, 135. (5) *Matthews*: Jour. Am. Med. Assn., 1926, lxxxvii, 1802.

# Society Transactions

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## AMERICAN GYNECOLOGICAL SOCIETY

*FIFTY-THIRD ANNUAL MEETING, WASHINGTON, D. C.*

*April 30, May 1 and 2, 1928*

### Symposium on Pelvic Infections

**Gonococcal Lesions of the Female Genitalia** (title changed), DR. ARTHUR H. CURTIS, Chicago, Ill. (For original article see October issue, p. 531.)

**Postpartum Pelvic Infections**, DR. BENJAMIN P. WATSON, New York, N. Y. (For original article, see October issue, p. 536.)

**The Treatment of Septic Abortion**, DR. GEORGE GELLHORN, St. Louis, Mo. (For original article, see October issue, p. 547.)

**Tuberculous Salpingitis**, DR. CHARLES C. NORRIS, Philadelphia, Pa. (For original article, see October issue, p. 552.)

**Cervicitis**, DR. FREDERICK C. HOLDEN, New York, N. Y. (For original article, see p. 624.)

### DISCUSSION

DR. PAUL TITUS, PITTSBURGH, PA. (By invitation).—Without doubt this matter of pelvic infections is one of the most important subjects confronting the medical profession at the present time. The very diversity of opinion that has been expressed in recent publications seems to show that it is far from being settled.

One or two points suggest themselves as being of practical importance to the patient herself, especially in connection with the treatment of cervicitis by cauterization. We know that the majority of these women who present themselves needing cauterization have leucorrhea as their chief complaint. We know also that leucorrhea can be aggravated most decidedly by the cautery, because the cautery itself causes a profuse discharge. Consequently we must warn the patient that this is to be expected for a time after the treatment else she is likely to be disappointed and to feel that the treatment has been so unsatisfactory that she will not go on with the further treatments so often necessary.

I believe that the patient should be directed not to take douches for at least two weeks after a cervical cauterization in spite of the extra discharge which is so common. There is a distinct risk that douches may force necrotic material up into the uterine cavity or even further. The suggestion naturally arises that those cases of cellulitis referred to by Dr. Curtis may have been in this way the result of douching and that the cauterization itself may be blameless in this connection.

Another thing to be borne in mind is that results cannot be expected too quickly from cauterization of the cervix; that six or eight or even ten weeks must elapse before we can see the final effects of this treatment.

DR. BARTON COOKE HIRST, PHILADELPHIA, PA.—Dr. Curtis sounds a new note of conservatism in the treatment of salpingitis. My conservative treatment used to consist in partial operations but I found I had to reoperate on about 60 per cent of these cases. In Montreal I have seen turpentine injected in pus tubes, and in Dr. Curtis' clinic a little over a year ago, I heard that pus tubes should not be operated on at all, but had the pleasure of watching Dr. Curtis then remove three pairs of pus tubes. Lately I have been evacuating these tubes whenever the pathology in their walls was not too great, and then injecting them with 10 per cent mercurochrome solution by means of a long nozzle, using some little force so as to establish a connection with the uterine cavity proved by the appearance of mercurochrome on the vulvar pad in the next day or two. It is too early to report on the results, but I mention it as one of the conservative methods of treatment of salpingitis.

I was much impressed with Dr. Watson's presentation and am in entire agreement with him except on one point. I think that interstitial streptococcic salpingitis with cornual abscess is a little more frequent than he intimates. It is often difficult to distinguish it from cellulitis with exudate. He was quite right in saying that cellular exudate should be let alone, but in the case of the cornual abscess and interstitial streptococcic salpingitis I have found that the later the patient is operated on the worse the condition becomes; the more involvement of tissue there is, the more radical the operation required.

Dr. Gellhorn surprised me by advocating the sharp curette for the postabortal uterus. For twenty years I have never inserted a curette in the uterus after an abortion or labor at term. Previous to that I was sometimes guilty of the practice. I never allow the word "curettage" to be used in connection with these cases. The procedure is always listed as an evacuation. I advocate the evacuation of the uterus without traumatism. Out of the long series of intelligent young physicians who have passed through my service as interns, I do not believe there is one who has left it without being convinced that the proper evacuation of an incomplete abortion is the most successful treatment.

Dr. Norris' paper requires no comment, but I might point out the occasional occurrence of tubercular endometritis in the puerperal uterus. I have had some remarkable cases of this sort and without a panhysterectomy I would not expect to save such a patient.

In regard to Dr. Holden's paper I cannot understand the neglect of diathermy in these cases. Most impressed with the results of Dr. Cumberbatch of London, I installed the apparatus for diathermic treatment and have been using it extensively ever since. I had a long experience with linear cauterization of the cervix but have almost entirely given it up. I think any one who tries diathermy in competition with it would come to the same conclusion. Excellent results can be obtained without destruction of tissue and without a trace of pathology afterward. There is no interference with the physiologic action of the cervical glands and the supply of the thick mucus that should plug the cervical canal. Without this plug there is an increase in the incidence of ascending infection, sterility and abortion.

In answer to the President's question about the technic of evacuating the uterus after an incomplete abortion: I dilate the cervical canal with Hegar's bougies, if necessary, then use the Emmet forceps. There need be no traumatism in the anterior of the uterus. Foul smelling masses of stuff are thus removed which cannot be left in the uterus with impunity. The average time of convalescence in the hospital is seven days. A great number of clinical charts could



be shown to support this contention. The temperature, which may be as high as 104°, usually drops to normal within 24 hours. The patient is discharged with no further bleeding and no fever. As a rule, no packing is used. Even when the infection has spread beyond the uterine cavity we do not hesitate to evacuate it if it contains a large amount of putrefying decidua. Surely this would be considered good surgical judgment in any other body cavity or deep wound, in which a mass of sloughing material would certainly delay healing, not to mention the danger of toxemia and of continued and spreading infection.

DR. J. WHITRIDGE WILLIAMS, BALTIMORE, MD.—In connection with Dr. Norris' paper on tuberculosis, I should like to direct the attention of the younger members of the Society to the fact that my thesis for admission to this Society thirty-five years ago was on genital tuberculosis. At that time I pointed out that unrecognized genital tuberculosis was much more common than generally supposed, and I am glad to see that every contribution which has been made since that time has confirmed my original statement.

The whole question of puerperal infection is extraordinarily interesting, and has taken up a good deal of my time; but I might add that had I talked to you ten years ago, I might have talked more convincingly than I can now. I note particularly what Dr. Watson has said concerning the possibility of the extension of the ordinary types of puerperal infection through the tubes to the peritoneal cavity. This, however, is contrary to my experience, as I have witnessed many autopsies upon patients dead from infection and have never seen any evidence of an ascending process through the tubes. I lay great stress upon this point, and each year I show my students microscopic specimens of tubes from cases of fatal puerperal peritonitis which show a perfectly normal mucosa. Occasionally, the peritonitic process may involve the lateral end of the tube, but in such circumstances it never extends far down into the lumen. Of course, in gonorrheal infection, the reverse is true; as in such conditions, the peritoneal infection is an ascending one.

What interests me most in Dr. Watson's paper is what he says concerning the cause of puerperal infection. All studies during the last generation have shown that in the vast majority of fatal cases the infection comes to the patient from without. With our present knowledge we can safely say, barring a few exceptions, that it is due to the aerobic hemolytic streptococcus, for whose introduction we are nearly always responsible. On the other hand, this is not always the case, as we sometimes see women die from aerobic hemolytic streptococcus infection who have had spontaneous labors and have not been examined vaginally. Dr. Watson has increased our knowledge by directing attention to the fact that possibly certain such infections may come from the respiratory tract of those who have come in contact with the patient.

When we, however, consider the forms of infection not due to the hemolytic streptococcus, and inquire whether there is such a thing as autoinfection, we immediately get into difficulties. For years I have taught that for practical purposes, with the exception of gonorrhea, we can practically act as if autoinfection were impossible.

Recently, I reviewed the last 5000 deliveries occurring in my service up to Nov. 1, 1927, paying particular attention to the occurrence of infection. It is our custom whenever the temperature rises to 101° or more on two consecutive days to remove a sample of lochia for bacteriologic study. We have almost an equal number of white and black patients in our material, and I was surprised to find that infection was noted more than twice as frequently in the colored as in the white women, notwithstanding the fact that all had the same prenatal care, and are delivered by the same staff in the same operating suite, and with the

same technic. Furthermore, when we came to consider the bacteriology in these cases, we found that streptococci in general occurred a little more than twice as frequently in the blacks as in the whites, and this held good whether the women had been examined vaginally or not, or had or had not sustained a perineal tear.

During the past 18 months, Dr. Harris has devoted special attention to the study of the streptococci cultivated from 102 women delivered on our service; 28 having been delivered by operative means and 74 spontaneously. He found that streptococci were present in 27 white and 75 black women; in other words, 3 times more frequently in the latter. Upon analyzing the various types of streptococcus he found that 7 of the white and 10 of the black women had showed the beta hemolytic variety; and from what we know of the subject, we are prepared to admit that we probably introduced them into the birth canal. On the other hand, he showed that in the remaining 85 patients we had to deal almost entirely with anaerobic streptococci which could not be grown upon the usual media. In 4 of the whites and 15 of the blacks we had to deal with anaerobic hemolytic streptococci, while in 8 of the whites and 29 of the blacks, we had to deal with aerobic nonhemolytic streptococci, in other words he showed that anaerobic streptococci, whether hemolytic or not, occurred 5 times more commonly in the blacks than in the whites; and for this fact some explanation must be adduced. In the entire series there were two deaths, one due to hemorrhage and shock from placenta previa and occurring two hours after admission; while the other was a neglected eclamptic patient who died from pneumonia 36 hours after admission.

Taking these facts into consideration, it is apparent that we have to face the very remarkable phenomenon, that in our clinic infection occurs twice as frequently in the blacks as in the whites. Furthermore, we find that the serious form, due to the aerobic hemolytic variety, occurs with about equal frequency in the two races; while infection due to the nonhemolytic anaerobic variety appears approximately 5 times more frequently in the blacks.

What does this mean? I do not know exactly. At first glance, one is tempted to assume that the black patients are dirtier than the white and consequently may harbor bacteria in their genitalia to a much greater extent. This would be a very simple and satisfactory solution, but, unfortunately, certain as yet unpublished work by Dr. Harris does not appear to bear out this conclusion, so that I am unable to answer the question; but the fact remains.

The more I see of obstetrics in the two races, the more it is borne in upon me that colored women resist infections of all kinds less well than white women, so that it is within the range of possibility that colored women may be constitutionally inferior to white women, and thus are unable to resist infection to the same extent. This is a point which I think we must bear in mind not only concerning blacks and whites, but also concerning our general population. Everyone is familiar with the relatively high death rate from childbirth in this country, which is higher than in any other civilized country in the world; and it has occurred to me that it may possibly be due to some constitutional inability to resist infection which has developed as a consequence of the admixture of races in this country. Whether this is true or not, I cannot say; but at least it would be a more comforting conclusion than that we do dirtier obstetrics than elsewhere.

Had you asked me a few years ago what I believed concerning the presence of streptococci in the vagina of normal pregnant women, I should have replied that I did not believe in it. Now, I am afraid I shall have to modify my views, and to say that while I still hold the same belief so far as the occurrence of aerobic hemolytic streptococci is concerned, evidence from my own service forces me to believe that it does not necessarily hold good for the nonhemolytic anaerobic variety.

The question of the treatment of infected abortion is a very important one, and the very fact that one set of observers can adduce large series of statistics showing excellent results from conservative treatment, while other equally competent observers obtain equally good results with operative treatment, must mean that the difference between the two methods of treatment is comparatively slight. I take it that the crux of the matter is, that there is not much difference whether we treat the patient conservatively or operatively so long as the infection is limited to the uterus; but when it has extended beyond it, the patient should be left absolutely alone except in the presence of really alarming hemorrhage, and the more conservative the treatment, the better. On the other hand, if this distinction is not borne in mind, the results following radical treatment will be materially worse than those following conservative treatment. We have tried both methods and, barring the reservations just made, the results have been about the same with each.

DR. FREDERICK C. HOLDEN, NEW YORK, N. Y.—At the Bellevue Hospital during the last few years I have gleaned certain knowledge that might be presented here. I will show on the screen several slides illustrating the types of infection with which we have had to deal and the different forms of treatment. From 1920 to 1927 there were 14,000 cases of acute salpingitis, 4072 abortions. We never curette or enter the uterus in abortion. We remove the retained tissues with sponge forceps, pack the vagina tightly and, where necessary, repack for another 24 hours. We feel that the rate of morbidity and mortality is lower in our series than if the uterus had been entered. We cannot conceive of entering the uterus with any instrument and not breaking up the outer layers.

DR. JAMES E. KING, BUFFALO, N. Y.—From Dr. Curtis' paper I think that we have gained the impression that every case should be treated conservatively although he has specified that 15 per cent of his cases were operated upon. We can all admit the possibility of erring in operating upon such cases too commonly, but we are equally justified in saying that we may err also in not operating early enough on certain cases. Any gynecologist who allowed his patient to go on with a pelvic inflammation endangering the ovaries and which will necessitate, as Dr. Curtis himself has said, the sacrifice perhaps of one or both ovaries, I should say, had erred grievously in the direction of so-called conservatism.

In regard to abortions, I feel very much as Dr. Hirst and Dr. Williams do, that these cases may be properly cleaned out where the abortion has occurred after the second month. I do not believe the early abortion of six or seven weeks, that has been brought on by the midwife or shows evidence of infection, should be operated. Later when a placenta may be occluding the canal and preventing good drainage, it seems to me bad practice to leave the placenta there.

In regard to the tuberculous condition of the pelvis, our findings are about the same as Dr. Norris'. About 5 per cent of the cases of salpingitis operated on in the last ten years showed, by the pathologist's report, the existence of tuberculosis. Often at the operating table we are unable to say by the gross examination of the specimen whether it is tuberculous or not. Surgeons should have all extirpated tubes examined by a competent pathologist. Surgery, in these cases, represents only the smaller part of really required treatment of such patients.

DR. LILLIAN K. P. FARRAR, NEW YORK, N. Y.—As to the value of the ice bags in postpartum infections; several years ago at the Women's Hospital I recalled an article dealing with abortions treated by rest continued until patient was afebrile for four or five days. I asked permission to try it. We put all patients entering with an incomplete abortion into bed and kept them there until

they were afebrile. In addition we used an ice bag and found that this made a tremendous difference. After the temperature had dropped and the uterus had contracted it was found to be firm and it was considered perfectly safe to use the sharp curette. We also added pituitrin. Convalescence is very much quicker, the temperature hardly rises more than one degree and the patient is able to leave the hospital at the end of a week. If there is any placental tissue left in the uterus the ice bag helps to prevent infection.

DR. O. H. SCHWARZ, ST. LOUIS, MO.—In 1924 we began to grow our uterine and blood cultures, both under anaerobic and aerobic conditions. In this work we followed very closely the technic of Schottmueller published in 1910. In a very short time we were able to confirm all of Schottmueller's experiences, and published an article concerning these facts in the *American Journal of Obstetrics* in April, 1927. Schottmueller, who is an internist, has a large septic ward in Hamburg, and Heynemann, the gynecologist in the same clinic, has a similar service. They see many anaerobic infections and are inclined rather to the radical treatment of infected abortion than to the conservative. In postpartum infections, however, Heynemann is very conservative. It is also our experience that anaerobic streptococci play an important rôle in puerperal infections.

As regards treatment in infected abortions, it was clearly stated by Williams that if the infection had spread beyond the uterus the case should be left alone as far as possible. In the absence of such obvious spread and in the presence of a discharge or with the products of conception retained, evacuation of the uterine cavity should be performed. Whether the evacuation is done in one way or another does not seem to be so important, so long as no sharp instruments are used and no rough manipulation is carried out. It is best done with the finger, a dull instrument, or an ovum forceps. We often employ an ordinary sponge forceps. We prefer also give a uterine douche of 1-4000 potassium permanganate under low pressure after this procedure.

The general practitioner should be impressed with the necessity that cases of infected abortion should be immediately hospitalized and an obstetric consultation obtained.

DR. WM. R. NICHOLSON, PHILADELPHIA, PA.—It seems to me of the utmost importance that one particular point should be stressed, namely, the necessity of a thorough external cleansing of vulva and perineal region before any vaginal examination is made during any stage of labor or abortion. I agree with Dr. Williams that the majority of infections are introduced from without.

I myself cleanse the introitus of the vagina and perineal region of every patient whom I am about to examine. Based upon my experience this thorough external cleansing is the most important single prevention of puerperal sepsis at the present day since the various items of the armamentarium are now carefully prepared and are surgically clean.

DR. JOHN A. MCGLINN, PHILADELPHIA, PA.—The discussion today has brought very strongly to my mind the danger of dogmatism. I think that the mortality of appendicitis today is higher than it was ten years ago because the cases are not coming in so early as formerly. Many persons have misinterpreted Ochsner's statement not to operate on these cases early. I do not believe that Ochsner meant that they should not be operated upon in seventy-two or ninety-six hours, but only in a certain type of case should operation be delayed. But because of these dogmatic statements, the general practitioner is not sending his cases in early. The same thing holds true in relation to the statement that the curette should never be used in an abortion. That statement has been misinterpreted to read

that an abortion should never be interfered with. Dr. Holden showed that he interfered with 150 cases and yet it was stated that in Philadelphia they never interfered. He meant that he did not interfere with septic abortions. I do not believe that anyone would hesitate to interfere in an incomplete abortion. Unless the case is brought in promptly and operated upon, infection is being invited. The general practitioner is getting the idea that abortions should not be interfered with and, therefore, the surgeon does not get them until they are badly infected. In cases of incomplete abortion I empty the uterus, in the absence of temperature, because I believe that a contracted uterus is in no danger of infection. If the infection is limited within the uterus and there is a mass protruding from the cervix I lift it out in a way that will clear the uterus, certainly not with a sharp curette, but with a forceps, followed by packing. I believe that the safeguard in any case of abortion is a contracted uterus and unless the uterus is contracted down the infection is apt to spread.

DR. EDMUND B. PIPER, PHILADELPHIA, PA.—I understand that before I arrived Dr. Gellhorn said that mercurochrome intravenously was of no use. Dr. Watson said practically the same thing. I agree with Dr. McGlinn that when people use the word *never* they get themselves into trouble. For instance, Dr. Holden said he never curetted a case and then showed 150 cases that he had curetted.

I agree in a measure with Dr. Gellhorn in regard to mercurochrome. I brought mercurochrome out originally because I hoped it would cure puerperal sepsis, but it does not, and I said three years ago that it does not cure. But when one says that it does not do any good in any kind of a case, it shows that he does not know how to use it. You cannot take a blood stream infection, where you have a local infection continuously pouring out microorganisms, and expect to sterilize the blood stream.

In 1925, I stated before this Society, that I dreamed a dream and it became a nightmare. As far as blood stream infection goes in other parts of the body, particularly in children following mastoid operations, we get some very good results. I recently read in a textbook that the way to give mercurochrome was 25 c.c. given every day for a number of days. I wrote and told the writer that those patients given mercurochrome in that way would have acute nephritis, stomatitis, enteritis, and would probably die.

Dr. Watson and I agree, I am sure, in all his statements except that I would not quite agree that mercurochrome is of no use whatever. Whether there is an infection is dependent upon three factors: dirty obstetrics in the first place; second, the resistance of that particular individual; and third, autoinfection.

DR. WILLIAM A. SCOTT, TORONTO, CANADA.—I am convinced that if the principles laid down by Dr. McGlinn were carried out in general practice a very dangerous procedure would cease: the practice of unnecessarily packing abortive cases. The idea has reached the general practitioner that septic abortions are to be treated for the most part in a conservative manner but, as Dr. McGlinn pointed out, often the physician does not distinguish between the aseptic and the early nonaseptic abortion. One of the most common symptoms is bleeding, but packing for it is often used unnecessarily and with very great danger of converting a nonseptic condition into a septic one.

Dr. Watson pointed out that many cases harboring hemolytic streptococci in the cervix previous to delivery pass through an uneventful puerperium, that some of the patients develop severe infections from their own endogenous bacteria,

but the aliens introduced with manipulations prove more dangerous to them. But what is an autoinfection for one patient might become an alien infection for another and for this reason we are, as far as possible, taking cultures from all our ante-partum cases. Thus we discover those which represent a potential danger to other patients and keep them isolated.

DR. WILLIAM P. GRAVES, BOSTON, MASS.—Our observations have led us to the conviction that strictures of the genital tract constitute an important etiologic factor in the production of cancer. This conclusion relates not alone to the stenoses of the internal os and external os of the cervix but also to those of the upper and middle vaginal canal, and even to those of the vaginal introitus. We find the condition especially frequent in association with cancer of the uterine body; and with sufficient frequency in cancer of the cervix to regard it as a probable causative factor. We have repeatedly been able to show that obstructed genital drainage is an important element of irritation in the production of leucoplakia and kraurosis of the vulva, both of which conditions must be regarded as potentially precancerous states.

If these conclusions are true, they are of far-reaching import both to the general practitioner and to the gynecologic specialist. Not only must strictures be recognized at and after the climacteric, but in the general treatment of gynecologic patients throughout life. The possibilities of later contractures must be continually visualized and preventive measures taken. Every time that a plastic operation is performed, or the cautery used, or radium applied, one must calculate, and allow for, the atrophic changes that the menopause will produce in the tissues.

The subject is of much importance in the general care of women who have passed the menopause. All women, especially those who have not had children, should receive an expert examination at the climacteric and at stated intervals thereafter. If stenoses are encountered they should be rectified by proper operative measures that establish competent drainage throughout the genital tract.

In regard to cases of chronic pelvic inflammation, we believe in releasing ovaries from adhesions, on the general principle that immobilized pelvic organs cause discomfort.

Freeing an adherent ovary often causes severe lacerations. But these lacerated organs can be adequately repaired by skillful plastic maneuvers, so that they may retain their full function with little or no reformation of the adhesions.

The other question raised by Dr. Curtis is that of leaving small bits of ovarian tissue either in situ or in distant parts in order to retain a semblance of menstruation. Like Dr. Curtis we have seen a number of patients who after such treatment suffered from interminable menstrual molimina. We, therefore, endeavor to leave ovarian tissue sufficient in amount to maintain full menstrual function, and if this cannot be done we favor the clean sweep.

DR. BROOKE M. ANSPACH, PHILADELPHIA, PA.—In our service we do not operate on pelvic inflammatory cases unless we are unable to relieve the symptoms in any other way or we wish to open the tubes to favor conception. If we operate for the relief of symptoms we remove the focus of disease, which is usually the tubes, and conserve the uterus and ovaries as best we may. Operation for opening the tubes is not often successful and we never do it only for the purpose of favoring conception without the patient's full knowledge of the small chance she has that the operation will achieve its purpose.

As to the question of the prevention of puerperal sepsis, I am in hearty accord with what Dr. Nicholson said about the thorough preparation of the patient for examination. In the treatment of this condition I am more than ever convinced

that operation should never be undertaken unless there is a localized collection of pus and then it should be opened in the simplest way.

I still believe that mercurochrome and the other intravenous antiseptics have a place in our therapy. I have seen good results from their use, especially as adjuvants to other plans of treatment. If the incomplete abortion case is clean, the uterus should be emptied, but in the case of septic abortion how are we able to tell whether the infection is in the uterus or has gone beyond the uterus? Our practice is to treat the condition conservatively until the temperature comes down, unless there is much bleeding, and then we control it and promote dilatation of the cervix by the insertion of a pack. The products of conception are afterwards removed with the finger and placental forceps.

The woman who has symptoms following labor from a retroflexion should be treated, if possible, with a pessary and not operated on until her reproductive period is at an end. Profuse leucorrhea occasioned by an everted cervix is not controlled by the correction of the uterine position. It can be cured only by trachelorrhaphy or by cauterization. The cautery allows us to make these women comfortable for the time being with the pessary, doing the repairs and correcting the displacement later by an operation.

DR. FRED L. ADAIR, MINNEAPOLIS, MINN.—In leaving healed tubes, does Dr. Curtis attempt to differentiate between gonorrheal and postabortive tubes? I am afraid to leave the tube with a history of postpartum or postabortal infection. We rarely operate during the first attack of a salpingitis but we find many cases returning who on account of their economic conditions cannot afford to spend repeatedly much time in a hospital. If there are palpable masses which are giving them symptoms and causing recurring disability, we then operate.

We see relatively few cases of tuberculosis of the genital tract in our clinic. This might be due to the fact that all our tuberculous patients find careful and extensive hospitalization in our state and county tuberculous hospitals.

In regard to Dr. Watson's paper I wish to mention that a number of times it has happened in our municipal hospital that coexistent with epidemic infections of the upper respiratory tract we have had definite outbreaks of infection in the obstetric wards, affecting not only the mothers but also the babies. We have made nose and throat cultures of all the personnel on the floor, of every one having to do with the technic of the floor. We had a very striking illustration of the multiplicity of carriers in an outbreak which we had this winter. All the personnel of the floor showed throat and nose cultures positive for streptococcus and staphylococcus, some harboring both organisms. However, there was one exception. A nurse who had been out of the city on a vacation until 24 hours before had a negative culture. The procedure we have found most effectual is to require the whole personnel to wear masks covering both the mouth and nose in addition to other usual precaution as gowns, washing hands between handling patients, etc.

Another point that I think is very important in this connection is the overcrowding of an obstetric floor. Overcrowding leads to overwork of the personnel, laxity in technic, etc. We have now learned to stress this in the prevention of these conditions and try to avoid overtaxing our normal capacity.

I will simply state what we do in managing infected abortions. We usually expose the cervix with a speculum, and any tissue or blood clots or products of conception which lie in the canal are removed without entering the uterine cavity if this be possible. This usually controls hemorrhage and also provides freer drainage from the uterus. If we cannot control the hemorrhage in this manner

we insert a pack, but this is seldom necessary. We try not to invade the uterine cavity in any febrile case or any case which is potentially infected, by which we mean a case which has been manipulated before entrance into the hospital. It is relatively safe to enter a uterus once but to enter a second time is extremely dangerous and most of the fatal cases of sepsis which I have seen following abortion have been cases where the uterus has been entered more than once. In practically all the cases we ultimately empty the uterus before the patient leaves the hospital but usually not until they have had from three to five days of normal temperature.

We should remember in teaching the students that many of them will be general practitioners and will have to work in the homes of rural communities and we should not teach them a technic they cannot safely apply in such an environment.

DR. JOSEPH L. BAER, CHICAGO, ILL.—In the Michael Reese Hospital of Chicago we insist on the complete masking, and that applies to all including those who come in contact with the armamentarium. We believe also that the house staff should have the opportunity to do an initial vaginal examination which establishes a more accurate status *presens*. For this examination the patient and the examiner are prepared as for delivery.

After Dr. Danforth had proved the harmlessness of pituitrin given immediately after the end of the second stage we adopted that as a routine. The placenta separates very quickly. This avoids manipulation of the uterus which sometimes causes severe trauma and thrusts the cervix into the introitus exposing it to infection.

The treatment of puerperal sepsis in our service consists essentially in rest, a high Fowler position, abdominal ice bag, an abundance of nourishment, and neither specific vaccine therapy nor chemotherapy. However, believing in the correctness of the newer physiology of the body defenses, we do occasionally use a foreign protein shock or when the patient's condition is grave, repeated small blood transfusions.

For the septic abortions we believe that the uterus should be emptied, granted that there is no broad ligament or adnexal involvement. If we feel that the uterus is the sole point of infection we have no objection to removing the infected debris, preferably using the Hegar dilators to admit the finger and then with the finger separating such particles as are attached and removing the contents with the ovum forceps. If the cervix is closed we pack the vagina until the cervix is sufficiently softened, usually 12-18 hours. The sedimentation test more delicately than the leucocyte count establishes the absence or presence of infection, shows the severity of the infection and its progression or retrogression. We use the cautery freely as a treatment for cervical erosions.

DR. CURTIS (closing).—Dr. Titus inquired whether douches were used in those patients who develop cellulitis following cauterization. One of my hobbies has been the avoidance of douches and all of our patients are urged not to employ them. Dr. Graves' discussion pleases me very much. I hope he appreciates not only the importance but also the frequency of cervical obstruction.

It is not always possible to differentiate in old healed tubes as to whether they are of gonorrheal or of streptococcic origin. If there is a question relative to removal of a doubtful ovary, we believe that more radical surgery is indicated in streptococcic infection than in gonorrheal disease of equal severity.

DR. WATSON (closing).—I think that every one has agreed that in the vast majority of cases the organisms that cause puerperal infection are introduced



from without and I would like, therefore, to emphasize the importance of the preparation of the patient and especially the thorough masking of nose and mouth not only at time of delivery, but from the time that the first examination of any kind is made and up to the first two or three days of the puerperium.

The observation of Dr. Williams in regard to the incidence of those infections in the colored as against the white race brings out what I said as to the susceptibility of the individual, and that an organism which is alien is more likely to cause serious infection than one to which the patient may have become immune.

The important point of the discussion has been about the question of conservative as against radical treatment both in postpartum and postabortal infection. The divergence of opinion may have seemed to be great, but after all it is very little as between those who have advocated an absolutely conservative treatment and those who have advocated a more radical treatment. We must remember that those who have advocated radical procedures are skilled men who carry out these procedures with the greatest gentleness. I believe that this Society sent forth the message that the indiscriminate emptying of an infected uterus was advocated it would be a bad thing for the population at large because unquestionably these things would be done by men who have not the proper equipment or skill to carry it out with the gentleness which is necessary if ill effects are to be prevented. When an infected uterus has to be emptied I agree with Dr. Gellhorn that it is safer to do it with a large, sharp loop curette than with a blunt curette or the fingers, using the sharp curette as a snare to remove the fragments. This will not damage the uterine wall but will accomplish what is necessary.

Dr. Piper rather thought that I had decried the mereurochrome treatment of puerperal sepsis. I did not mention it at all in my paper. I look upon it, as upon the other methods of intravenous therapy including blood transfusion, as a nonspecific therapy which may in a large number of cases do good simply by raising the patient's resistance.

DR. GELLHORN (closing).—The discussion as far as it pertains to the treatment of septic abortion, has been dominated by a strong tendency toward conservatism with which I personally am wholly in accord. But while we who control hospital wards, may well observe a "masterful inactivity," the individual obstetrician or general practitioner is, as a rule, subject to pressure from without which is impatient of any sort of watchful waiting. It is for this reason that I suggest a compromise. If after three days of observation the parametria and perimetrie tissues are found involved or if only a tenderness is detected upon examination, this indicates a progressive infection in which the uterus under no circumstances should be cleaned out. If, however, after three days no such involvement has occurred, we may assume that we have to deal with a less harmful infection, perhaps only a sapremia, and proceed to the evacuation of the uterus even in the presence of fever. This criterion seems much safer to me than bacteriologic laboratory examinations with their conflicting findings. My proposal, therefore, is a perfectly legitimate pragmatism, not a betrayal of principles for the sake of convenience.

—In case we have to empty the uterus, I still believe, that the very large, sharp loop curette is safer than the dull curette and the placental forceps, provided it is used with gentleness and caution. If we have failed to impress the necessity of such caution upon our students, we have, I fear, been remiss in our fundamental duties as teachers.

The prevailing mercurochrome fashion will in time go the way all other bactericidal injections have gone. In this method only the brilliant red color is new, the principle is old.

DR. JOSEPH BRETTAUER, NEW YORK, N. Y.—It appears to me that the views expressed in this discussion are not so divergent as they seem and that we have derived considerable knowledge from them. For instance, in the methods employed it is not so much a question of what to use as how to use it. In the hands of experts the result is the same and no harm is done, whether the method used be the forceps, the blunt curette or the sharp curette. The majority of the speakers are ultraconservative, which is a quite different attitude from the one prevailing at our meeting here five or six years ago, and entirely changed from the extremely radical one of some fifteen years ago.

**Premarital Examination and Instruction as Routine Preventive Gynecology**, DR. ROBERT L. DICKINSON, New York, N. Y. (For original article, see p. 631.)

#### DISCUSSION

DR. EDWARD A. SCHUMANN, PHILADELPHIA, PA.—In the light of present day medical thought, one must necessarily agree with most of Dr. Dickinson's propositions. In so far as premarital examination goes I am thoroughly in accord. As to the best procedure to be adopted, should such examination disclose disease in one or the other of the contracting parties, I am not so sure. Venereal disease and other illnesses readily amenable to treatment offer no great problem, since the deferring of marriage until cure is complete, is a fairly simple matter. But when one considers the question of the chronic constitutional lesions as tuberculosis, for example, the problem becomes involved.

There are three ways of dealing with this solution. First, we may rigidly exclude persons suffering from transmissible disease from marriage and procreation. Second, we may allow marriage and procreation in the hope that through the constant introduction of resistant blood into any family strain the virulence of the disease may be attenuated until all of its force is gradually spent. Third, we may agree that civilization has progressed so far that physical excellence is no longer a matter of special importance and that the citizen of today is possibly far more valuable to the State by reason of mental attainments than by physical perfection. The old aphorism "*Mens sana in corpore sano*" may be much overdone. I confess that I should have suffered a keen personal loss had Robert Louis Stevenson's tuberculous mother been prevented from marrying and giving her illustrious son to posterity.

Now as to the spacing of children. Here, again, I wonder! Men have been breeding animals selectively and eugenically for many, many years and except for the exaggeration of special characteristics, their efforts have resulted in degeneration rather than improvement. Virility, strength, longevity, all have suffered under man's breeding principles as opposed to those of Nature.

I feel convinced that the natural time for reproduction as chosen by Nature's laws will produce better offspring with greater possibility of carrying the torch of human race betterment, than synthetic families, conceived and born at such times as best suits the economic exigencies of their parents.

**Pyelitis and Pregnancy, DR. JAMES W. DUNCAN, Montreal, Canada.**  
(By invitation.) (For original article, see October issue, p. 557.)

### DISCUSSION

DR. WILLIAM C. DANFORTH, EVANSTON, ILL.—Our knowledge of this subject has been growing steadily during the last two or three years. The importance of ureteral obstruction as an etiologic factor in pyelitis of pregnancy is receiving an increasingly greater amount of attention. Last year I presented a series of thirteen cases of pyelitis of pregnancy in all of whom after delivery obstruction of urinary drainage still existed. Schreiber of New York, reporting on a series of 100 autopsies studied in Europe, was able to show that 12 per cent had a hydro-uretero-nephrosis of some degree which was dependent in every instance upon a narrowing of the ureter either at its pyeloureteral junction or at the vesical portion.

Dr. Duncan has already referred to the communication of Dr. Hofbauer in which he brings out the muscular hypertrophy which occurs in the trigone with the result that the vesical end of the ureter is narrowed. The important fact is that a definite obstruction of urinary drainage exists and that this during pregnancy is apt to be much exaggerated. Treatment of this condition must be based upon this fact. The essential thing is to establish urinary drainage. The possibility of focal infection elsewhere in the body, which with a urinary stasis due to obstruction may cause a hematogenous infection of the kidney and its pelvis, should not be overlooked. Eradication of focal infections is of importance. We should not look upon pyelitis of pregnancy as a transitory condition which requires little attention. These cases do require active treatment not only during pregnancy but some time thereafter.

DR. NORRIS W. VAUX, PHILADELPHIA, PA.—Dr. Curtis, in his work done some years ago came to the conclusion that there was some definite obstruction in the lower urinary tract during the course of pregnancy. This blocking has been beautifully shown by the slides of the hydronephrosis which Dr. Duncan has so well demonstrated.

In 1923, studying a series of some fifty cases which I reported before this Society, we were able to determine definite edema or swelling in the trigone of the bladder. We did not have pyeloureterograms made of all cases at that time, and we were uncertain that the dilatation of the ureter was a definite factor, as well as the trigone swelling and edema. Associated with this there was a turning up of the lower ureteral orifice and in some cases a very definite residual urine was present.

In a fairly extensive maternity service, both outpatient and hospital, we have found pyelitis occurring in pregnancy to be much more common than we had previously thought existed. When a case appears at our clinic that shows a great deal of sediment, particularly pus in the urine, we have that case report for further cystoscopy and ureteral study. We have found that by taking such cases before they develop true pyelitis symptoms, and also those cases that have only a small amount of pus in the urine, and by treating them prophylactically we believe that we are able to cut down a definite percentage of cases that would develop pyelitis later in their pregnancy.

We have found a dilatation of the ureter in pyelograms such as Dr. Duncan has shown in his slides in a few cases, but have not known how to account for it other than that it may have been a permanent condition present.

DR. GEORGE GELLHORN, St. Louis, Mo.—Dr. Duncan's beautiful demonstration supplies anatomic proof of ureteral obstruction which, he says, leads in turn to urinary stasis and this again to infection. But since this obstruction is physiologic in pregnancy, if I understood him correctly, the occurrence of pyelitis should be expected in practically every pregnant woman; at any rate, it should occur more frequently than it actually does.

Is it not possible to consider dilatation (not obstruction) of the ureter as the primary thing and explain it as being caused by a lowered tonus of this structure due to pregnancy changes in the vegetative nervous system? Such an explanation would render more plausible the very marked dilatation of ureters which has been disclosed by x-ray pictures in the earliest weeks of pregnancy.

I do not believe that an ascending infection of the bladder is a frequent cause of pyelitis because there is usually no history of bladder symptoms prior to the attack. Focal infections may undoubtedly be responsible for some cases of infection of the kidney pelvis, but this etiology is probably rather rare.

It is much more likely that the chronic constipation in women which is so often aggravated in pregnancy, plays the decisive rôle. The intestines, like the ureter, have a lowered tonus in pregnancy, and this physiologic dilatation, which in extreme cases may even lead to ileus, gives the colon bacillus a chance either to wander through the intestinal wall into the ureter or, more likely, to enter the circulation whence they would have to be excreted through the kidneys. I have for some time paid particular attention to this point and noticed that pregnant as well as nonpregnant patients with pyelitis give a history of constipation prior to their attacks.

The practical application is self-evident. Stoeckel and others have demonstrated the beneficial effect of thorough mechanical cleansing of the intestinal canal; and with me, copious colonic flushings form an integral part of the treatment of pyelitis.

Another reason why the obstruction theory of pyelitis does not fully satisfy me, is the observation that a simple ureteral catheterism often suffices to relieve the syndrome for the rest of the pregnancy. Yet, as the obstruction remains or forms again soon after the catheter is withdrawn, one would logically expect a return of the symptoms.

In closing, may I be permitted to point to the danger of puerperal sepsis from a neglected pyelitis. It is quite conceivable that in such a case urine contaminated with colon bacilli or other bacteria, may run into the vulva during labor and give rise to childbed fever. This possibility alone demands most energetic treatment of the pyelitis during pregnancy, and long-continued observation after the confinement so as to forestall a recurrence in the next pregnancy.

DR. DUNCAN (closing).—In regard to Dr. Danforth's remarks I might say, we have endeavored to work out the question of focal infections. We have attempted in a series of rabbits to create focal infections in various parts of the body as close to the kidney, as in the hepatic flexure of the colon, and have not been able to recover, uniformly, in the tied side or the untied side of the ureters, direct cultures of coli. The possibility that a focal infection in the tonsils or sinuses or teeth might lower the woman's powers of resistance, plus an obstruction, might very well explain that woman falling an easy prey to pyelitis.

In regard to drainage, I would simply point to our postpartum cases in answer to Dr. Danforth's query; no doubt, with drainage established in these postpartum cases the danger of developing an infected condition will be much lessened.

In answer to Dr. Vaux's question as to constipation, we have fully realized the extreme danger of constipation. After tying the transverse colon of rabbits with a loose ligature, bringing about an incomplete stasis, we have actually been able to recover from the ureter the bacillus coli in the tied side, also a positive culture in the urine on the tied side under the most rigid technic. In the untied side we have not been successful in recovering coli from the bladder in large quantities, whereas in the undisturbed, undamaged glomerulus we have found the Bacillus coli, so that we have concluded from this series of experiments that if we go on further it may be possible to demonstrate that constipation plays a very large factor in the development of pyelitis.

In reply to Dr. Gellhorn, I would point out that congestion has a tremendous effect upon the ureter and upon the parametrium, which is one of our main claims for the production of obstruction and that occurs as early as the sixth week, in no way preceding the slight dilatation such as we have shown.

The distortion of the trigone which begins in multiparae at the sixth week and in primiparae at the tenth week, associating itself with a mild degree of dilatation, is physiologic and does not become pathologic until the twenty-fourth week, when stasis makes its appearance. I am in sympathy with Dr. Gellhorn's remarks about the parasympathetic nervous system. There is no doubt that it plays a part in the case with which the ureter gives way. I quite agree that the patient should be treated clinically along the lines which he suggested. I would point to the fact that this stasis has a very grave effect but it begins to disappear about the ninth day postpartum.

### **A Comparative Study of Certain Gynecologic and Obstetric Conditions as Exhibited in the Colored and White Races, DR. C. JEFF MILLER, New Orleans, La. (For original article, see p. 662.)**

#### **DISCUSSION**

DR. WILLIAM T. PRIDE, MEMPHIS, TENN.—One feature of Dr. Miller's paper is especially interesting to me and that is the abnormal deliveries. Some years ago I left Philadelphia and entered practice in Memphis and was very much surprised at the measurements that we obtained in pelvimetry. In Philadelphia we had not assumed any difference between the colored and the white, but in the South we always found the difference. I tabulated over a period of years about 1500 cases, part of them taken from the South and part from the North, and we found that the difference existed not only in the negro, but in the Northern and Southern negro.

Dr. Williams reported about 4000 cases some years ago but naturally he took all of his data from Baltimore. Mine taken from the North and from the South demonstrated that the Northern negro is larger in pelvic measurements than the Southern; that the Northern white woman is larger than the Southern.

Our deliveries are not operative as often in the colored as in the white. I have always attributed that to the fact that they are stronger, they stand pain better, and our statistics prove that they will labor very much longer without any assistance than the white woman will.

There are many other features of this subject that are interesting, for instance eclampsia. We see eclampsia more frequently in the colored race according to our statistics. I think that is due to neglect. Since we have been running

an outpatient department and have about 500 cases under observation, the incidence is much less but even now the colored have eclampsia more frequently than the white.

Birth injuries, as Dr. Miller has shown, are very much less in the colored race than in the white, and we are surprised at postpartum examination to find the patient in perfectly good condition in the colored race and often we find the reverse true in the white woman.

DR. DE WITT B. CASLER, BALTIMORE, MD.—Dr. Miller's paper has brought up a number of problems in which we, in Baltimore, have been interested for a long time. We have realized, as he has, that the negro presents a very different problem from the white. As Dr. Miller has brought out, the colored come in with larger tumors, with greater complications, and they can stand more extensive operations in a much better way than the white patients.

Dr. Miller's statistics correspond in some ways very closely to ours; in other ways, they differ very much. As far as pelvic inflammations are concerned, we have always realized that they are more frequent in the black race, especially gonorrhea and lues. Tuberculosis of the pelvis is about one and a half times as frequent in the colored as in the white. The difference is even more striking in regard to tuberculous peritonitis, which is just about two and one-half times as frequent in the colored, as in the white. As to the granuloma inguinale, we rarely see it in the white race.

One of the rarest operations that we see in Baltimore is postpartum repair of a vaginal tear in a colored woman. We seldom do an operation for suspension following childbirth uncomplicated with pelvic inflammatory disease. Colored people are emotional but they are not neurotic patients.

Some few years ago, I went over all the cases of suspension of the kidney that had been done from the early days of the hospital, and out of many hundreds of cases, there was only one suspension done on a colored woman. That case was operated on six months later for tuberculosis of the kidney, and the diagnosis had been wrongly made in the first place.

We differ with Dr. Miller in regard to carcinoma. In the last 2000 cases we found the numbers of black and white patients about equal. In fifteen cases of adenocarcinoma of the fundus, there was only one colored woman. Almost exactly the same percentage holds true in the endometrial tumors of the ovary. In the last 2000 cases, we had 17 chocolate cysts of the ovary, and only two of them in the colored race. Carcinoma of the cervix is relatively on the increase with the colored patients, and at the present time we are seeing about as many in the colored as in the white. Fibroids are much more common in the colored race. Why this is, we do not know. One would naturally expect, as fibroids are so common in the colored women, that enlarged prostates would be common in the men, but on the contrary, the genitourinary surgeons tell us this to be extremely rare. Why that is so, is a difficult question to answer.

DR. EDWARD A. SCHUMANN, PHILADELPHIA, PA.—I bespeak the attention of the Society to a problem in this connection that I have been studying for a number of years. It appears that the intermarriage of a mulatto for two or more generations produces a fairly stable race and anthropologists have begun to become interested in the occurrence of this so-called American phenomenon in a group of people breeding true and with a high mental index. I have carefully observed these people over a long period of years and they seem to have inherited, contrary to the usual rules of hybrid races, diseases incident to both the black and white. Resistance to gonorrhea, syphilis and tuberculosis is very high and

this particular race of people seem to withstand surgical traumatism and shock with as great efficiency as either the colored or the white race from which they sprung. I would call attention to this phenomenon and ask that the members seek to observe and corroborate my statements if possible.

DR. ALFRED PLAUT, NEW YORK, N. Y.—We have been told that carcinoma of the cervix has about the same occurrence in white and in colored women. It has been shown also that carcinoma of the body of the uterus is much rarer in colored women than in white women. This statement is very interesting in relation to the widespread opinion that myoma uteri is a predisposing factor to carcinoma of the fundus. For, as we all know, myoma uteri is very frequent in colored women. I never saw a real proof of the statement that myoma predisposes to carcinoma; I cannot consider Nobel's paper as convincing. The occurrence of myoma is so frequent that only a strict mathematical analysis can give any reliable statistical data concerning this connection with another disease. The fact that colored women with their high incidence of myoma seldom have carcinoma of the body appears as a sort of proof to the contrary of the assumption that myoma predisposes to carcinoma.

It would be well if we could have a similar check-up on the relation between carcinoma of cervix and laceration of cervix during childbirth. The belief that laceration is a chief causative factor in cancer of cervix seems so widespread and firmly rooted that it needs courage to say that one does not believe in it. Here, again, both lesions are very frequent; there are few women at the cancer age who have not had cervical laceration from childbirth, and thus a real relationship between both diseases is extremely difficult to prove statistically. Certainly the laceration should be repaired, but cancerphobia is a bad disease also.

DR. JOHN A. MC GLINN, PHILADELPHIA, PA.—The colored race presents some problems in the North but not to the extent that it does in the South, which bears out what Dr. Miller has said. Out of all the cases of granuloma which we have had at the Philadelphia Hospital only one was in a white woman, all the rest being colored. In fact, I have seen only two cases of granuloma in white women. My experience is the same as Dr. Miller's, that when a colored woman comes in for pelvic inflammatory disease the lesions are so extensive that they usually require total extirpation of the pelvic organs.

DR. MILLER (closing).—A study of the negro race, especially in connection with the changes in their environment, is a task which will require the aid of the ethnologist. It cannot be done purely by the medical men. It is almost impossible at the present time to classify the negroes in our hospital services in any but the most general way; that is, it is no longer possible to identify them as to their original tribal affiliations. The Congo type is undoubtedly the best of the original races.

I differ with Dr. Schumann as to the stability of the mixed type. We find that they have not the resistance of the pure black type, and as a matter of fact, for the most part they succumb very readily to disease and they withstand surgery badly. The most remarkable thing, to my mind, about the negro in his civilized environment is the way he has lost his immunity to the so-called diseases of civilization, particularly intestinal disease. He has always had a weakness for pulmonary disease, and the same situation is now developing, as my figures show, in regard to intestinal disease.

Immediate and Remote Results in Two Hundred Twelve Cases of Prolapse of the Uterus, Drs. JOSEPH L. BAER and RALPH A. REIS, Chicago, Ill. (For original article, see p. 646.)

DISCUSSION

DR. HILLIARD E. MILLER, NEW ORLEANS, LA. (By invitation).—As this paper very clearly proves, successful results can be expected in the management of uterine prolapse only if each individual case is considered on its own merits. All successful operations, however, have certain underlying premises in common. In the first place, the vaginal canal, like the inguinal, is normally oblique, and, like it, is protected chiefly by the action of intraabdominal pressure. In the second place, once the obliquity of this canal is destroyed by injury to its supporting fascia and once the ligamentous supports of the uterus are weakened, descensus of one or all of the pelvic organs is the inevitable result, the degree depending upon the extent and the location of the injury. In the third place, prolapse of the uterus is essentially a hernia which may involve not only that organ but also the adnexa, the bladder, the rectum and the vagina. Any operation, therefore, for the correction of uterine prolapse must restore the supporting fascia and the ligamentous attachments of the uterus, and thus restore the obliquity of the vaginal canal, before it can be expected to correct the herniation of the pelvic organs.

In our experience the Watkins interposition operation has secured these results in all properly selected cases. This operation must never be done in the child-bearing period unless special indications exist and the patient agrees to sterilization. I noticed that Dr. Baer's percentage of sterilizing operations is higher than in our service. The interposition operation is not adapted to cases in which the uterus is so hypertrophied that high amputation of the cervix or partial resection of the fundus will not reduce it to approximately the normal size, nor is it adapted to cases in which the uterus is too small to serve as a proper support for the bladder.

If the cases are properly selected, failures are very few, as we proved by a follow-up of our patients a few years ago. We averaged more than 90 per cent of cures with this procedure.

I was surprised to see the small percentage of cases of incontinence reported by Dr. Baer, and I presume it is due to the fact that women, for some reason, simply do not complain of this symptom.

A most important point is the treatment of these cases prior to operation. A rest in bed to reduce the edema of the parts and restore as far as possible their normal relations, plus the treatment of possible bladder pathology will go far to make the convalescence smooth and the operation a success.

DR. HARVEY B. MATTHEWS, BROOKLYN, N. Y.—The type of patient, the familiarity with the operation that is chosen and the dexterity with which the individual operator can perform that operation are the most important facts in regard to results. The success of the operation depends a great deal upon how efficiently the parts are prepared before operation is begun.

In regard to sterilization, we are in the habit, rather than ligating or dissecting out the tubes, to insert a capsule of radium, 25 to 50 milligrams in those cases in which the poor condition of the patient does not warrant additional ligation of the tubes.



The grading of the degrees of prolapse is an important point. Dr. Baer's division corresponds with what we use for teaching purposes at the Long Island College Hospital. If the worker in this field would standardize the division according to his scheme it would clarify a very confused subject.

Dr. Baer had 54 cases or 24.5 per cent of pathologic conditions in the cervix. This seems like a very low incidence.

There were 96 cases of prolapsus uteri operated upon in our clinic during the past six years. Dr. Baer employed nine different types of operation for prolapse while we have used seven different types, as follows: Watkins interposition, 36 cases; Vaginal fixation, 18; Vaginal hysterectomy, 5; Panhysterectomy, 3; Murphy fixation, 6; Baldwin-Emmett operation, 8; and Vaginal plasties with suspension of the uterus, 20 cases.

We have more recently left a retention catheter in the bladder in all vaginal plastic operations. I got this idea from Dr. George Gray Ward at the Woman's Hospital of New York, who uses the mushroom retention catheter in all his radium cases. It occurred to me that it might be good for any bladder that had to be catheterized. We leave such a catheter for from 7 to 10 days and find that it saves a lot of distress to patients, and much work to the nurses.

DR. HIRAM N. VINEBERG, NEW YORK, N. Y.—When one listens to a statistical paper of this kind one cannot but recall the fact that if you operate on two cases of complete prolapse, you know in advance that one case is likely to be successful and the other unsuccessful. So much depends upon the tissues, and whether the vaginal wall is thinned out, how much the fascia is separated, etc.

I would like to ask Dr. Baer the number of cases in which the amputation of the cervix was done? In my experience unless one does that in practically all cases the results are not particularly good. The operation in childbearing women with a certain amount of prolapse in my experience may be done in a simpler manner, and it serves the purpose very well. Incision is made just as one would for an interposition, the bladder is pushed up in the same way, but the peritoneum is not entered, and then the first fixation suture passes through the vaginal wall and fascia and in the cervix about the level of the internal os.

DR. GEORGE GRAY WARD, NEW YORK, N. Y.—One should bear in mind that it is necessary to classify the cases as to whether they are in the childbearing or non-childbearing period, in deciding which is the best procedure to follow. In the group of cases of nonchildbearing patients it is important to consider the age of the patient and one must study the individual case carefully and select the operation that is best suited for her. In other words, I think no one operation can be said to be the correct one for all cases.

Dr. Baer certainly has been fortunate in following up such a large percentage, but I note that he said from four months upward, to as long as eight years. Four months, in our opinion, is a time entirely too inadequate to judge the result of these cases of prolapse. At the Woman's Hospital we insist on two years as a minimum before we give a final classification as to the result of procidentias.

As to the choice of operation, if the uterus is a perfectly healthy one and of proper consistency and size, a Watkins operation may be the best procedure, but we do not hesitate to remove the uterus if it is not suitable. Apparently in Dr. Baer's clinic they conserve the uterus in nearly all cases. If the patient is past the childbearing age or the menopause, we are partial to the Mayo procedure for many of the cases. I believe Dr. Baer said in his vaginal hysterectomy cases

there were 100 per cent results. We do not get 100 per cent results but we get a very fair percentage with that operation.

I noticed that he had 29.5 per cent where a catheterization was necessary. We think that there is always a stasis of urine due to atony after the bladder has been extensively manipulated, and for several years we have habitually used the self-retaining catheter in all of our vaginal cases.

DR. HERMANN J. BOLDT, NEW YORK, N. Y.—I will refer only to one operation which I have missed in the tabulation given here. It is the operation devised by George Edeohls. The operation is not any more difficult than any of the others. It might take a little longer time than the Murphy operation, but the stay of the patient in the hospital is very markedly decreased. I have not had any of the cases remain in the hospital longer than one week. There is no operation, in my opinion, that equals it.

In the childbearing period the operation that has given me the most satisfactory results is ventral fixation combined with a plastic operation.

DR. ROBERT T. FRANK, NEW YORK, N. Y.—Dr. Baer's results are good. I do not think that we can claim 85 per cent of successes, but it is very difficult in this type of lesion to analyze another man's work because each case is a case to itself, and much depends on the completeness of the follow-up. That he only got 45 per cent of good vaginal plastic results surprises me. Here in the United States there are two groups, the one favoring preservation of the uterus at almost any cost, the other favoring hysterectomy as a routine portion of the operation. Abroad I think hysterectomy is rarely practiced because if the result is bad it is tremendously difficult to deal with the resulting hernia.

As Dr. Ward said, it is necessary to divide these patients into two groups, those who still desire to bear children and those who have sufficient family, or are no longer of the childbearing age. And here I want to make a mild plea for the despised pessary which received a "kick" in the *Journal of the American Medical Association* only a few weeks ago.

As to our results, we have a good follow-up; we follow between 90 and 95 per cent of the patients from three to five years before we consider the result final. Our patients in the ward are worn out by life's struggle, many have cardiac and renal complications, so that in many cases I have to choose between taking a certain amount of risk or leaving the patient unable to cope with her duties in life. We desire, of course, a short operation and yet often I cannot get along without a prolonged intervention and, therefore, necessity has forced me increasingly to use parasaeral anesthesia for the vaginal part of the operation and then adding a short gas-oxygen anesthesia for the ventral fixation. Our type operation in the main is an anterior and posterior vaginal plastic, the technic of which need not be entered into here and which must be a bit different for each individual case, and, where there is uterine descent, a firm ventrofixation if no children are to be borne, or an Alexander's operation to permit of childbearing.

DR. DOUGAL BISSELL, NEW YORK CITY.—The classification of degrees of uterine prolapse made by Dr. Baer is that commonly accepted by gynecologists but to which I seriously object. It is misleading and should be abandoned.

When the uterus descends and reaches a point where the cervix only passes out of the introitus, the corpus remains within the vaginal area with the possibility of further descent. The limit of descent is reached only when the corpus has passed out of the introitus with an accompanying eversion of the vaginal walls.

All degrees of descent of the uterus are partial until the entire organ protrudes. Therefore our classification should consist of two great groups, *incomplete* and *complete*.

In the incomplete group we have two or more degrees. For convenience, however, they may be divided into first stage which would be any permanent descent of the uterus with patient in standing position, to a point where the cervix reaches the introitus. Second, where the entire cervix protrudes. In the complete group there can be but one stage.

The term "complete prolapse of the uterus," when applied to a uterus with its cervix protruding but the unattached corpus still within the vagina, is incorrectly applied because it refers to the entire organ whereas actually it includes only to the cervix.

DR. GEORGE GELLHORN, ST. LOUIS, MO.—For the comparatively small group of total prolapses in old women who are past the age of sexual relations, Dr. Baer has recommended the Le Fort operation. I would like to show two lantern slides illustrating the technic of this operation which, designed in 1876, has fallen into an entirely undeserved oblivion. What Dr. Baer said about the end-results, is quite true, as this method will avail even in cases where other procedures have failed. Another reason for recommending this particular operation for old women is that it can be performed without any inhalation narcosis. At first I used to do it under local anesthesia, but in the last year or two I have found that a good twilight sleep is all that is needed. (Slides shown.) Only when a perineorrhaphy is added, this final step requires local anesthesia.

DR. LILLIAN K. P. FARRAR, NEW YORK, N. Y.—Dr. Matthews spoke of using a retention catheter in plastic operations. It is such a radical procedure and has given such satisfaction that I would like to speak of it in more detail. We used this method at first in order to keep the interns in bed after radium had been applied and the vagina tightly packed. We began to use it later for preventing colon bacillus infection in cases of retention of urine.

There was no staphylococcus or streptococcus infection observed from leaving a catheter in the bladder. There was no case of stasis where the catheter was left in for seven days. It has been of the greatest comfort to the patients, since they do not have to be catheterized. The method has saved time for the nurses. The important thing about it, however, is that there has been absolutely no infection resulting from leaving the catheter and not one pyelitis in the 70 cases.

DR. BENJAMIN P. WATSON, NEW YORK, N. Y.—In regard to the retention catheter, I have used it in these cases as a routine for over ten years and I think it is useful in several ways. First, if one is operating on a cystocele and has done a reconstruction of the fascial support of the bladder it is important that the strain should be kept off the sutures by preventing distention of the bladder, and secondly, it prevents infection of the bladder. I think more damage is done to the pelvic floor by catheterization of the patient than by any other single procedure. One does not realize perhaps the difficulty the nurse has in catheterizing a patient on whom a repair of the pelvic floor has been done. I am perfectly certain that many of the bad results, especially on the anterior part of the pelvic floor repair, are due directly to traumatism during catheterization. The retention catheter for three or four days is, therefore, of great benefit.

DR. BAER (closing).—As to Dr. Miller's reference to the low incidence of incontinence in our series, we regard loss of urine on exertion, such as coughing or sneezing, as an impairment rather than a true incontinence.

These cases require preparation. Many of them are edematous, many of them have ulcers of the cervix, and we usually put them to bed with elevation of the foot of the bed and such treatment for the restoration of tissues as may be necessary before beginning any operative procedure. We sterilize by surgery rather than by radium. Sterilization when indicated should be positive and surgical sterilization is most certain.

We have a low incidence of operated cervical pathology; 54 patients out of 212 in whom the hypertrophy, etc. required amputation or plastic. I agree that this is lower than the percentages in the literature. Dr. Jeff Miller's series is about the same as ours. Dr. Hermann Grad had a 66 per cent cervical amputation; Dr. Phaneuf had 79 per cent, yet I think that is largely a matter of interpretation. Some of us regard a cervix with shallow bilateral lacerations as harmless and do not believe that it requires repair. This may account for some of the discrepancy.

Intelligent selection of cases is, of course, the fundamental factor in the determination of the type of operation.

I agree that our shortest time for the followup may not have been long enough to justify inclusion of these more recent patients in the series, but since all our end-results were evaluated personally by the same group of operators, their judgment of the outcome should be trustworthy half a year after operation.

**Epidermoid Carcinoma of the Cervix Uteri: A Histologic Study to Determine the Resemblance Between Biopsy Specimens and the Parent Tumor Obtained by Radical Panhysterectomy, DR. KARL H. MARTZLOFF, Portland, Oregon. (By invitation.) (For original article, see October issue, p. 578.)**

**Cervical Cancer, End-Results of Treatment by Radiation Therapy, DR. WILLIAM P. HEALY, New York, N. Y. (For original article, see October issue, p. 594.)**

#### DISCUSSION

DR. CURTIS F. BURNAM, BALTIMORE, MD.—As Dr. Martzloff presented his paper the question occurred to me as to how the tissue was taken in the biopsy. It is necessary to take a good deal of tissue and perhaps from deeper and various parts of the tumor if we are going to use the cellular classification in deciding on the outcome and choice of treatment.

So far as the coincidence of radiosensibility and cell type is concerned, my own experiences have been very much like those of Dr. Healey. However, I think that a little caution should be observed both in prognosis and in treatment in deciding on the malignancy of any growth by its cell structure. One can ascertain certain general trends and certain general effects, but will find exceptions that are not so very uncommon. A histologic picture indicating low grade malignancy sometimes is associated with a high grade of clinical malignancy. Such tumors may be radiosensitive or not. In my experience this variation occurs in all the epitheliomas, but is commoner in the adenocarcinomas of the cervix. A recent case presented the histologic characteristics of papilloma, and yet rapidly metastasized over the body.

In radiating carcinomas of the cervix there are certain cardinal factors. The first is concerned with the distribution of the radium, the intensity of the treatment, duration of treatment and question of dosage. The second is to know whether or not there is secondary bacterial infection present in the cervix; wherever possible all cases should be preliminarily treated to get rid of such infection, particularly the streptococcus varieties. The third is the histologic grade of malignancy, and the fourth, while imponderable, is all important, that is the natural resistance of the patient to the growth, also the ability to tolerate radiation. So far as I know there is no method of determining in any case this factor, but it is a very important one in the outcome of treatment.

DR. ROBERT T. FRANK, NEW YORK, N. Y.—It is well not to be confused by different terminologies, or by different points of view. After all, when we view the cancer question today it is well to look back quite a distance in medical annals. When I think of the classification of cancer I am always reminded of the celebrated Trousseau's description of tuberculosis in which he covered pages with the pathology of different types of diseases that were then suspected to be tuberculous. If we ever learn to know what the cause of cancer is, our point of view will be quite different and we will no longer be so uncertain in analyzing or classifying the different reactions of epithelium to this parasitic or whatever cause it may be.

I agree with Dr. Martzloff that biopsy is disappointing in cataloguing tumors no matter how extensive the biopsy may be. Even examining many areas of a completely excised tumor leaves you in difficulty when deciding in which class it belongs. I do not operate for carcinoma of the cervix. I have not done so for many years, and I no longer have this material at my disposal. I cannot agree with the authors who attempt to establish a malignancy index and the reason that I consider such an index fallacious is manifold, part of the causes being enumerated by Dr. Burnam. Besides the morphologic degree of malignancy, evidenced by the number of cells and their mitosis, the stroma and amount of connective tissue reaction, and the as yet unanalyzable response of the patient must be taken into consideration. Consequently, the value of biopsy must be limited to making a diagnosis of the presence or absence of malignancy. Any further deductions as to the extent of invasion and the prognosis should be based on the extent of the disease and on local conditions rather than upon a purely pathologic basis. Sometimes when there is a marked malignancy so far as the cellular pathology would indicate, the radiosensitivity, at least in contradistinction to the surgical results, is such that the worst looking tumors under the microscope may give the best results.

DR. WILLIAM P. GRAVES, BOSTON, MASS.—The figures given by Dr. Healy are astonishing. His report renews the hope, that I had once formed and later given up, that the differences in cell-type of cervical cancers would be of great clinical importance in determining the nature of the treatment.

What I am about to say represents the conclusions reached in our clinic from our own observations and those of others. Dr. Healy's figures are much more definite than those compiled at the Free Hospital for Women by Dr. Smithwick and Dr. Pemberton and reported by Dr. Pemberton to this Society two years ago. Our figures were so little convincing that we abandoned the idea that the differentiation theory is of any great practical value in the radium treatment of cervical cancer, and we have subsequently paid small attention to it.

Our viewpoint has been somewhat as follows: We question, whether there actually exists a specific radiosensitivity of the cancer cells based on cell-type. The evidence of such a cell-quality is only empirical and circumstantial in that it is deduced only from the clinical results of radium treatment. The so-called radio-

sensitivity of a given tumor is synonymous with its amenability to the effects of radium. Now this latter may, as Dr. Healy and others believe, be due to an innate variable sensitiveness of the cancer cell to radiation, or, on the other hand, it may conceivably be the result of numerous other factors of the mechanical or constitutional nature that have little to do with cell-type. Dr. Burnham has referred to this in his discussion.

That there are other important factors was brought out by Smithwick and Pemberton in our series. They both found, for example, that the amenability to radium of a given cervical cancer depended more on the relative preponderance of connective tissue in the tumor than on the cell-type. I would like to ask Dr. Healy if he would not agree that the presence of connective tissue is a protective agency in limiting the spread of the disease, and in offering a better chance for cure from radium?

Secondly, a word should be said regarding adenocarcinoma of the cervix. Dr. Healy did not mention this type of cancer in his paper. Why is it that adenocarcinoma of the cervix is particularly radio-resistant? Regaud even recommends operation in these cases in preference to radiation. Is it not reasonable to suppose that its resistance to radium is due to the fact that it is peculiarly invasive or endophytic in character and, taking its origin higher up in the cervix, is consequently less accessible to the radium rays?

There is a third disturbing fact that throws some doubt on a special radio-sensibility of cell-type. Why is it that adenocarcinoma of the body of the uterus is not amenable to radium treatment? This radio-resistance cannot be the result of cell-type, since metastases of the same tumor in the vaginal wall are extraordinarily susceptible to direct radiation, as we have repeatedly been able to show.

The inference that we have drawn from this experience is, that cancer of the body of the uterus is radio-resistant simply because its disadvantageous location prevents the adequate application of radium rays.

Early accessible cancer of the cervix is amenable to several methods of cure other than radium, all of which are purely mechanical in their action.

In a recent review of cervical cancer cases at the Free Hospital for Women dating back to 1875, we have found five patients treated by high amputation and cautery, of whom two lived for more than 10 years, three for more than 20 years; one is still living 40 years after operation. In three of these cases including the last named, diagnosis was confirmed by biopsy, and in the other two the pathologic description leaves little doubt of the diagnosis.

It has been my belief that radium when properly applied to cancer cells, kills them as surely as does the knife or cautery irrespective of whether they are anaplastic or adult, spindle or spinous, unripe or ripe; and in the last analysis there is no more justification for the expression radio-sensitivity than there would be for knife, or cautery-sensitivity.

DR. JAMES E. KING, BUFFALO, N. Y.—Three important points are often overlooked which if considered will not infrequently give a hint as to the prognosis and treatment. It is a well recognized fact that the younger the patient the more rapid the growth and the more extensive the lymphatic involvement. The second point is the type of tumor. The infiltrating type is more likely to have early metastases and will often, even in an early growth, show wide lymphatic extensions. The third point is also very important, and that is that intangible something, call it immunity or resistance or what you will, but that something that resides in all of us which when present helps to determine a cure, and when absent is one of the factors that gives rise to early extension and recurrence at the point of local growth.

Dr. Healy has touched upon the question of lymphatic extension where the local tumor has been cured. I would like to show one slide which will illustrate fairly well this fact. This patient was in the early forties when there was discovered a very early, infiltrating type of carcinoma. She was treated by radium and eight months before her death she complained of vague pains in the abdomen. It was only two months before her death that the pelvic involvement was found. At autopsy was found the small shrivelled uterus; bladder, rectum and adjacent tissue were not involved, but the entire retroperitoneal tissue was a complete mass of carcinoma, the abdominal vessels being completely surrounded by this extensive growth. This is the third case of this kind that has come under my observation and all of them were early cases and gave clinically and microscopically a perfect local cure, and yet the involvement of the retroperitoneal tissues was extremely extensive.

DR. GEORGE GRAY WARD, NEW YORK, N. Y.—I wish to show four slides which give the results that we have obtained at the Woman's Hospital by irradiation of the cervix. These are five year results in 1920, 1921 and 1922. Two years ago we reported at the meeting of the American Medical Association our results and since that time we have two more five-year series and we have been able to continue the follow-up on the cases previously reported.

In primary carcinoma of the cervix treated with radium alone, our five-year end-results of all classes show 24.6 per cent of the cases traced and 23.1 per cent treated living today. Of the early cases class I and II we had 56.7 per cent traced and 53.1 per cent cases treated living after 5 years.

DR. HEALY (closing).—Both Dr. Burnam and Dr. Graves referred to the question of adenocarcinoma. We did not touch upon that subject at all. We were discussing only epidermoid carcinoma of the cervix which represents about 96 or 98 per cent of all primary cancers of the cervix in our experience. In only 2 to 4 per cent are adenocarcinomata of mucous gland origin found. There are quite a number of errors in diagnosis, however. Cases that are called adenocarcinoma of the cervix are often not true adenocarcinoma but are secondary to adenocarcinoma of the corpus or are secondary structural variations in primary epidermoid carcinoma of the cervix that resemble adenocarcinoma.

Of the early cases in Dr. Bailey's list that we reported, two were adenocarcinoma of the cervix and have remained well now for seven years.

We think that one of the important things that our study brings out is the decided difference between surgery, which is a purely mechanical agent, and irradiation therapy which is a biologic agent. Therefore, the results in surgery are always going to be handicapped tremendously by the malignancy of the tumor cell under consideration and we feel that our study makes this suggestion to the man who still feels that he must do a hysterectomy: if he wishes to improve his results he will be wise to have biopsy specimens of his cases first, and if he finds that the case is in the third or so-called anaplastic group he should avoid operation on that case. The surgical results are poor in that group.

DR. ARTHUR H. CURTIS, CHICAGO, ILL.—Dr. Graves stated that it is his belief that radium gives unsatisfactory results in carcinoma of the body of the uterus. My understanding has always been that operation yields such fine results that we need not turn to radium. In those instances in which operation has been contra-indicated and in which we have employed radium in treatment of corpus carcinoma our results have been very satisfactory. I wonder whether the experience of others is in accord with Dr. Graves' statement?

DR. WILLIAM P. HEALY, NEW YORK, N. Y.—We believe that there is a limited number of cases of adenocarcinoma of the body of the uterus that will respond to radiation satisfactorily but you must divide adenocarcinoma of the body of the uterus into two types: the so-called superficially growing adenocarcinoma which is not an invading type of tumor; and the infiltrating adenocarcinoma which quickly extends into the lymphatics and throws out distant metastases. The first group responds well to radium; the second group represents essentially a surgical condition.

The Surgical Treatment of Sterility, DR. WILLIAM KERWIN, St. Louis, Mo. (By invitation.) (For original article, see p. 641.)

### DISCUSSION

DR. BROOKE M. ANSPACH, PHILADELPHIA, PA.—As a basis for my remarks, I took the 46 cases of sterility consecutively seen in private practice since we began to use the Rubin test in 1923 until November of last year. I have followed all but two. I excluded all in which a preliminary test showed the husband unfitted for procreation; all in which sterility was simply one of a group of symptoms and



Fig. 1.

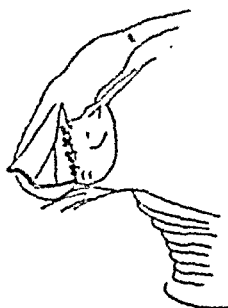


Fig. 2.

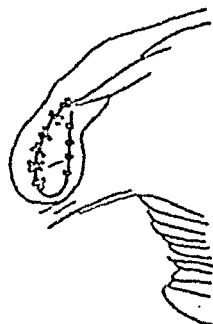


Fig. 3.

not the chief complaint; all with gross pelvic disease and manifest pathology, and all in which the sterility had not lasted for the accepted measure of time—in the absolute cases, three years, and in the secondary cases, two years.

A small part of the treatment was surgical; most of it consisted in the use of alkaline douches preceding coitus, elevated hip posture, local treatment of infected cervixes, calcium lactate, etc. Five times we dilated the cervix and used a stem. Once we shortened the round ligaments and elevated much hypertrophied ovaries. Four times we did a salpingostomy. The results show that if you give the sperm and the ovum half a chance they will do the work.

There were 26 Rubin positive tests in this series and pregnancy occurred in 17. Dr. Thos. R. Morgan, who does the Rubin tests for me, reported 6 modified positive cases, that is: a small opening on one side and occlusion on the other. In this group, there was one pregnancy; two had questionable early miscarriages. The result of the 17 pregnancies in 24 Rubin positive cases was a healthy child at term in ten; normally pregnant at present—one patient at two months and one at four months; four early miscarriages and one cesarean for toxemia at the seventh month. In judging a patient sterile, we made sure that persistent efforts had been made to become pregnant.

In regard to the efficacy of the treatment we advised, we cannot draw sweeping conclusions because four of the patients went three, and one patient four years before she became pregnant; meanwhile they had stopped doing what we advised



or did it only in a desultory way. In seven of the cases, however, conception occurred within seven months.

The outcome of attempts to open the tubes has not been satisfactory in my experience. Being unaware of the excellence of Dr. Kerwin's and Dr. Gellhorn's work, we tried to find a plan of operation which would assure a permanent passage-way between the ovary and the tube, especially applicable to those cases in which the obstruction occurred at the outer extremity. My associate, Dr. Alfred Heineberg, devised such a plan, in which he opens the bulbous extremity of the tube and partially buries the ovary within it. (Figs. 1, 2, and 3). A sodium iodide picture taken six weeks after Dr. Heineberg's operation showed that one of the tubes was open, so that his plan evidently was unsuccessful in so far as maintaining a communication between the tube and the peritoneal cavity as well as the surface of the ovary; subsequent circumstances have withheld the possibility of conception in this case.

All of the salpingostomies that I have done have been failures, partly at least because the occlusion has recurred. I would be inclined to think that the inlaying of the strands of catgut must be a considerable factor in the large proportion of successful results reported by Dr. Kerwin. I have never urged the operation of salpingostomy. I had one very distressing experience. In this case the injection of sodium iodide was followed by a great deal of pain. The temperature, however, was elevated only for a few hours and rapidly subsided and I operated within two weeks. This patient developed a streptococcus peritonitis and died within 36 hours. There is a real danger in these operations unless we take the greatest care to be sure that there is no lurking infection in the tubes. I would not operate again in such a case until two months had passed after an iodide injection.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—Dr. Kerwin's results are rather remarkable. We have performed this operation 51 times and we have had seven successes with ten babies as a result. The point made by Dr. Kerwin, and which should be emphasized, is the selection of cases. There are two classes of cases in which this operation is applicable: One, the hydrosalpinx where the abdominal ostium is closed by a perisalpingitis as the result of an infection in the peritoneum; and the other, the gonorrheal case which has not been complicated by a mixed infection. Some good results may be obtained in these two groups of cases. With infection of mixed origin the failures will be frequent.

Dr. Kerwin's technic is similar to that which we have used. I would call particular attention to the point he made regarding preoperative preparation. The check-up of the sedimentation time, the injection of milk in cases with a gonorrheal history, all contribute to the success, and success depends upon just these two things—the selection of the case and the dexterity of the operator.

DR. J. C. LITZENBERG, MINNEAPOLIS, MINN.—If the accepted definition of the genius is correct, "the power of taking infinite pains," it requires a genius to treat sterility, for if there is anything that requires infinite painstaking it is the solution of the problem of the sterile woman. We are too apt to think in terms of our failures instead of the small percentage of our successes. Anyone who obtains 25 per cent of successes in any procedure for sterility has a success, and yet in discussing this paper we might say that Dr. Kerwin failed in 75 per cent of his cases. That is the way the profession is apt to look upon anything that we propose for the handling of cases of sterility.

Some years ago I advocated studying all women who were sterile to find out whether they had a low basal metabolism. So far as I know, the medical profession has not accepted my ideas very enthusiastically. I am achieving a 25 per cent

success only, but I am not discouraged. During this last year we have treated 15 women with a low metabolic rate and we failed in eleven, although I look at it in a different way that is, that we have succeeded in four and thus have created four exceedingly happy families.

**What Can We Learn From a Study of Mortalities?** DR. JOHN OSBORN POLAK, and DONALD G. TOLLEFSON, Brooklyn, N. Y. (For original article, see October issue, p. 600.)

### DISCUSSION

DR. FRED L. ADAIR, MINNEAPOLIS, MINN.—I have not made such an extensive analysis of the cases that I have to report and my analysis is limited practically to the fatalities. I agree very heartily with Dr. Polak so far as preoperative study of the cases is concerned. In some elective operations however it seems advisable to undertake the operation in spite of unsatisfactory conditions that have been discovered at the preliminary examination.

I have brought several sets of figures for comparison. The first group represents 190 cases comprising abdominal operations of different kinds in private gynecologic practice. The fatalities were a little over 3 per cent. The only fatality that resulted from what might be considered an elective operation was in a young woman who had been thoroughly studied and had been in apparently satisfactory physical condition. She had a rather large interstitial fibromyoma and was very desirous of having her uterus conserved. In this case a myomectomy was done and she subsequently developed a wound infection and later a peritonitis and died on the fourth day. The other cases of death in this series would hardly be considered as elective procedures. There were two interstitial pregnancies, one volvulus, one ruptured uterus and one bilateral hemorrhagic cyst. In addition to the laparotomies in the private series there were 358 vaginal operations, not including treatments with radium, in which we had no fatality. There were 548 cases in all with a mortality of approximately 1.1 per cent.

I have another series from the Minneapolis General Hospital, which represents a very diversified service, especially so far as the staff is concerned, no one man operating on any large proportion of the cases. In this series we have a total of 363 laparotomies with 19 fatalities, about 5.5 per cent. There were 51 hysterectomies of various types, with two deaths; one with a general peritonitis and the other from surgical shock. In 60 cases there were various types of uterine suspension, with three deaths or 5 per cent. There were various types of salpingectomy in 189 cases with 6 deaths, making a percentage of 3.2. One of these was from a fulminant streptococcic peritonitis, one from peritonitis, one from pulmonary embolism, one from secondary postoperative hemorrhage, one intestinal obstruction, and one a paralytic ileus. We had 19 extrauterine pregnancies. We had, aside from the laparotomies, 523 minor operations with 0.6 per cent of fatalities.

DR. JOHN FRASER, MONTREAL, CANADA.—Of the many interesting facts which emerge from this highly important study which Dr. Polak has presented to us, two stand out preeminently:

First, the importance in a clinic of any size of establishing definitely on a firm footing what is and what should be a relatively satisfactory operative result.

In our clinic during the period which has been passing under review we have had 2281 major operations with 67 deaths. This is our complete mortality in these operations, a mortality which works out at about 2.4 per cent, and this

mortality seems to me a justifiable one. In a complex clinic it is difficult to regulate the admissions, and with the great variety of cases admitted, some of which demand immediate attention we are bound to have a mortality over which we have not a complete control.

The second point I particularly want to emphasize is the importance of as prolonged a stay in hospital prior to operation as possible. We have had in our clinic for a long time a custom which possesses certain advantages. For instance, patients admitted for the purpose of abdominal operation are encouraged and are made to remain in bed for a definite interval, lasting at least four days, and preferably in certain cases, such as fibroids, for a longer time. Especially if the patient has suffered from hemorrhage, I do not think you can have too long a preoperative period. During this quiet interval it has been our custom to undertake a thorough general examination, frequently done by a trained internist. In this manner not only do we detect definite organic changes outside the genital area, but we are hoping there will be developed a system whereby we can sort out that unfortunate group in which we get the mortality. There is no question that there is a certain group of patients where one has made a careful examination and has been very careful at the operating table, and yet we meet with a tragic issue.

I realize with Dr. Polak the advantage of the blood count and the usual laboratory tests. The anesthetic in our clinic is administered by a trained anesthesiologist. We usually use gas and oxygen followed by ether.

DR. JOSEPH L. BAER, CHICAGO, ILL.—I wish to emphasize three points: First, the prolongation of operation. Dr. Polak showed on the chart that ninety minutes for the combined abdominal and plastic operation was safe. One method of shortening the time of combined operations would be to control the cervical condition at another time. That is usually a longer part of the vaginal work than any other and the cautery could take care of cervical pathology in many instances, either at some interval before the operation or several months after the main operation.

Second, the point that routine appendectomy is pernicious. I believe we cannot emphasize this too strenuously.

Third, the value of the sedimentation time as an indication of the absence or presence of infection. We are adhering to the sixty minute time.

DR. JOHN O. POLAK, BROOKLYN, N. Y. (closing).—The gross mortality in this series was 2.6 per cent and I am glad to hear that Montreal has a mortality of 2.4 per cent. We believe the mortality in elective procedures should be less than 2 per cent.

I wish to call your attention again to several points which were very rapidly passed over in the paper. First, as to the significance of blood change. Patients with leukopenia who had a white count of less than 7000, have shown a very much stormier convalescence than those with a normal blood picture.

Another important point is the significance of the sedimentation test. In the sixteen cases which we classed in the fulminating type of infection, there were twelve cases with lesions which showed inflammatory activity. Every one of these cases had a low sedimentation time and should not have been operated if we had adhered strictly to the 60 or 90 minute rule. I think 60 minutes is perfectly safe.

Our cases of embolism have been in the patients with low hemic content. Since we have transfused our patients whenever the hemoglobin is below 50 per cent and have insisted that all fibroids should have a longer period of rest in bed prior to operation, we have had fewer emboli. Since we have abolished the use of clamps

on the broad ligaments prior to ligating them, the incidence has been less. The woman who has a pronounced secondary anemia is more apt to have embolus because a small amount of infection is more serious to her. The woman who rests in bed increases her resistance. Embolus has occurred where omental adhesions have been extensive and trauma has been done to the omentum.

I feel we should all come out frankly and state our stories. We are always quoting our successes but seldom review our failures. It is very comforting to know that clinics like those of Drs. Chipman, Ward, and Adair also have an operative mortality.

**Clinical Results Obtained With Oxytocin and Vasopressin, the Recently Isolated Principles of Pituitary Extract, DRs. GEORGE GRAY WARD, EDWARD C. LYON, JR., and GEORGE S. BEMIS (by invitation), New York, N. Y. (For original article, see p. 655.)**

### DISCUSSION

DR. N. S. HEANEY, CHICAGO, ILL.—I would like to ask whether an inspection of the cervix was made in all these fifty cases to rule out tears of the cervix?

DR. F. C. GOLDSBOROUGH, BUFFALO, N. Y.—There has been a great deal of work done by the profession with pituitrin but without much agreement. Dr. Abel and his coworkers agreed not so many years ago that there was only one substance in pituitrin. The research department of a chemical manufacturing concern has concluded there are two principles and I think we should wait until we get proofs from pharmacologists before we accept these two substances.

I do not think that the slight blood pressure rise shown by Dr. Ward is particularly objectionable. There is a decided drop in blood pressure immediately after the delivery of the child and if pituitrin has any particular effect on raising the blood pressure it will not raise it to the point of being dangerous. The differences shown in this small series of cases are not so very striking as to show an advantage of the oxytocin over the old pituitrin preparations. As a depressor substance it is not of much value in obstetric work.

DR. JOHN O. POLAK, BROOKLYN, N. Y.—We have been making a study of this subject. First we made a study of the normal drop in blood pressure after labor and we found that the drop, except in toxemic cases, was a minor factor, a fall of from 10 to 15 points. In the toxemic cases we have seen a drop of from 30 to 100 points.

In the study of the two drugs we have not used the two ampoules as suggested by Dr. Ward but only one. In observations with one ampoule in 60 cases, 30 with pituitrin and 30 with oxytocin, we have found that there is little or no difference except that in the 30 cases in which oxytocin was used the blood loss was greater. In these cases the cervix was inspected.

In the third stage of labor in toxemic cases I do not believe that there should be any fear in using pituitary extract because its action is so transient.

DR. FRED L. ADAIR, MINNEAPOLIS, MINN.—The point which should be kept in mind is that there seems to be considerable variation in the action of pituitary extract on both blood pressure and uterine contraction. This extract presumably contains both the oxytocin and the vasopressin principles.

DR. WARD (closing).—I wish it clearly understood that we have not advocated the use of oxytocin in this paper. We were asked to make a comparative study and

in the limited time at our disposal we were able to select only 100 cases in order to test out the two products. We have simply recorded very carefully our observations and had the charts made. We do not in any way advocate the advantages of one drug over the other, but are simply presenting it as a clinical study and as it appears to us in this very small series.

We observed that the differences were very slight, as Dr. Polak did. In the first series of 48 cases the difference shown in the effect of these drugs was slight and in the last series we doubled the dosage on this account.

Replying to Dr. Heaney's question it has always been our custom to carefully inspect the cervix, for we believe that there is a distinct advantage in taking care of laceration of the cervix at that time. In other words, in this series there was no case where there was any bleeding at all that came from the cervix.

### Endometriosis Following Salpingectomy, DR. JOHN A. SAMPSON, Albany, N. Y. (For original article, see October issue, p. 461.)

#### DISCUSSION

DR. JAMES A. CORSCADEN, New York, N. Y. (By invitation).—Of the many points of interest in the biologic relation of this study to the subject of anaplasia, the similarity and yet the dissimilarity between the malignant and benign growths, there are three points that attracted my interest. First is the importance of proving or disproving the endometrial nature of these growths and certainly the great importance that this particular presentation has upon the evidence that endometrial tissue may be freely transplanted, that is, using the term of the plastic surgeon, free transplantation as against the pedicle transplantation. Should they be considered as resulting from free transplantation? I feel that the certain determination of the endometrial origin of these growths is important, because all endometrial tissue may easily be destroyed either anatomically or radiotherapeutically. This fact applies particularly to the extensive infiltrating endometriosis cases rather than to the simple chocolate cysts. Mutilating operations requiring resection of the intestine, broad excisions of the rectovaginal septum, seem to me to be unnecessary if it is certain that these are endometrial growths. Sterilization will accomplish what now is done with these severe operations. The only indirect evidence I have is offered by two cases in which operation was abandoned because of the extensive infiltration. Subsequently these patients were sterilized by irradiation and from 2 to 5 years they were symptom free and did not present on physical examination any evidence of infiltration.

The study of this endometriosis problem is very interesting. One reads the literature and notices that there is an enormous amount of direct evidence that spread by contact is common. The proof that there is an actual flooding of endometrial tissue from the uterine cavity out into the abdomen is less certain and in this respect I regard this present communication of Dr. Sampson's as most important. While to me he has not absolutely shown that these transplants were entirely separated from their circulatory supply, nevertheless the evidence here presented tends to show that some of them were and that the route of the endometrial transplants from the endometrium or the tubes toward the endometrial cavity has at last been shown.

The last point covers the case of a tumor which I lifted from the vaginal wall about 3 cm. below the level of the cervix, 1 cm. in diameter, covered completely by the vaginal mucous membrane but adherent to it. The woman had had no children and there had been no extraordinary trauma. She had had a myomectomy some years previously. The structure of the tumor showed a fairly large amount of

smooth muscle stroma surrounding typical small gland-like spaces, with more or less typical stroma of the endometrium, and after a long study it was pronounced adenomyoma. It is difficult for me to see how there could have been a free transplantation of this tumor in the absence of trauma to the mucous membrane and in view of the circuitous route it would have followed had it been transplanted through either the lymphatics or the blood stream.

DR. NOBLE SPROAT HEANEY, CHICAGO, ILL.—I am getting used to the sensation of coming to these meetings year after year and finding that Dr. Sampson has again outthought us and has a convincing explanation for a clinical phenomenon for which we have had some satisfactory explanation other than the truth.

When I was with Rosthorn in Heidelberg and later in Vienna I heard him advise the exsection of inflamed tubes rather than amputation in order to avoid the painful nodules occasionally found in reoperated patients. Since then I have avoided amputation for this reason.

I have had two cases of endometriosis of the abdominal wall where previously only salpingectomy had been performed. In both cases the uterus was firmly adherent by one or both horns to the incision line. One of these cases had a menstruating scar, but I am sorry to say I failed to make a thorough examination of the uterine horns.

Dr. Sampson refers to the two cases which I reported in 1925, of endometriosis of the laparotomy scar following incision of the fundus to remove gestation products. He feels that if a study were made in such cases endometriosis of the uterine scar should be found. I do not know whether this would be true or not. I did not open the peritoneum in these two cases, at least not widely enough to inspect the pelvic organs. Neither had symptoms suggestive of that at the time of the operation. Case one considered me directly responsible for her endometriosis and has passed from observation. Case two I have subsequently operated upon for fibromyoma with menorrhagia. The uterus was removed vaginally and no area suspicious of endometriosis was found in the uterus, though the normal appearing uterine scar was not microscopically studied.

I support Dr. Sampson in his recommendation to perform salpingectomy with the cautery. I have used the light nasal loop in treating such cases of endometriosis where I was anxious to conserve childbearing. Where I encountered lesions that were small and isolated or where they were superficial and could not be easily excepted I have used the nasal snare quite freely. At Dr. Curtis' suggestion I have observed their postoperative course and convalescent period most carefully and I have seen nothing to indicate that the cautery is harmful.

I have been opposed to operating upon cases of postoperative residual pain in the lower abdomen for "adhesions" if I could find no palpable difficulty under anesthesia and if the patient gave no evidence of constricted bowel or ureters. Dr. Sampson has found that among the so-called adhesion cases a moderate number owed their symptoms to unsuspected endometriosis. I shall study my cases more thoroughly and may operate at least upon those adhesion cases having dysmenorrhea even though not typical of endometriosis.

I had one case of endometriosis of the vagina following a plastic operation. I had done previously a curettement and high bladder advancement and the endometrioma was small and in the advancement scar.

I also am surprised at the infrequency of endometriosis of the laparotomy scar following cesarean section and have wondered if the infrequency might in some way be associated with that katabolic phenomenon called involution of the uterus.

In conclusion I would say that it looks to me as if the opponents of Dr. Sampson's etiology of endometriosis are in an inextricable corner.

DR. EMIL NOVAK, BALTIMORE, Md.—Each year Dr. Sampson gives us something more to think about in connection with his work on endometriosis and, as he himself says, “a few targets to shoot at.” As he showed his slides I was impressed by the fact that I could duplicate practically every one of them in our own laboratory from sections, not of tubal stumps, but of the interstitial portions of tubes which had not been removed but which were still attached to the uterus. This is particularly true in connection with salpingitis, especially of the type commonly designated as salpingitis isthmica nodosa. With this lesion the lumen of the tube often appears to split up, so that there are many islands of mucosa, sometimes tubal, sometimes endometrial, scattered throughout the muscle tissue. Whether this is due to a proliferative change in the tubal epithelium, or whether it is to be explained by the formation of many diverticulum-like outgrowths, I do not know. Dr. Everett, who is at present handling the routine pathologic material in our laboratory, made the same observation. It would, therefore, seem that before drawing any conclusions as to these changes which Dr. Sampson has described in connection with tubal stumps, one ought to check up the observation by studies of the interstitial portions of normal and inflamed tubes.

DR. SAMPSON (closing).—The possibility that the endometriosis in and about tubal stumps found at the second operation might have been present at the first one, was considered in this study. In two of the cases mentioned in my paper, where one tube and ovary had been removed at the first operation, an endometriosis was found in both uterine cornua at the second operation. These two cases were described as those in which an endometriosis was probably present in both uterine cornua at the first operation. I do not believe that one can always determine by the histologic structure of an endometriosis in and about a tubal stump whether or not it was present prior to the first operation. When the endometriosis evidently arose from the outgrowth of the tubal mucosa from the end of the severed stump, it would seem that the operation must have been responsible for it. Endometriosis was found in or about the tubal stumps in 30 of 36 patients who had had a previous salpingectomy or tubal sterilization. The incidence of endometriosis in this situation was surely much higher in these cases than in women who had not had a previous operation. The number of cases which I have studied is too small to accurately determine the incidence of misplaced müllerian mucosa in this situation, both in women who have had a previous salpingectomy and those who also have not been operated upon.

DR. H. S. EVERETT, BALTIMORE, Md. (By invitation).—We have been making sections through the uterine cornua in practically all of the uteri removed during the past year and we have observed very frequently this same picture that Dr. Sampson has shown. I have no exact figures and have not been taking sections further out through the isthmus of the tube, so that I cannot answer that portion of Dr. Sampson's question, but it is a very frequent picture in the cornual portions of uteri from which the tubes have not been previously removed.

DR. OTTO H. SCHWARZ, ST. LOUIS, Mo.—Where this actual endometrial tissue was found, was the fact taken into consideration that these cornua were stitched and therefore a considerable constriction was placed upon the lymphatics in this area? I believe it has been conclusively shown that endometrial tissue is also carried by way of the lymphatics and perhaps in the constriction of the lymphatic system this may have happened.

DR. SAMPSON.—I have not taken that into consideration.

**Cyclical and Other Variations of the Tubal Epithelium**, DR. EMIL NOVAK and DR. H. S. EVERETT (by invitation), Baltimore, Maryland. (For original article, see October issue, p. 499.)

#### DISCUSSION

DR. JOHN A. SAMPSON, ALBANY, N. Y.—I have never studied this problem and, therefore, am not in a position to discuss it. I have been much interested in the histologic study of the tubes of patients who were menstruating at the time the tubes were removed. These studies were made with a view of the possible finding of bits of endometrial tissue in the lumen of the tube and also of detecting the reaction of the tubal mucosa to menstruation. I was much interested in a cell which is frequently found wedged in between the tubal epithelial cells. The protoplasm of this cell does not stain and I, therefore, called it the "white cell." At first I found it only in the tube and hoped that it might be characteristic of tubal mucosa. Later studies demonstrated it in the uterine mucosa and in one instance in an ovarian carcinoma. The cell apparently wanders from the sub-mucosa into the overlying mucosa.

DR. EMIL NOVAK, BALTIMORE, Md.—We look upon these cells, which Dr. Sampson speaks of, as wandering blood cells. They give the impression of a nucleus surrounded by a clear halo.

DR. SAMPSON.—You do not consider them characteristic of müllerian mucosa?

DR. NOVAK.—No, we do not.

DR. SAMPSON.—I found out to my sorrow that they were not.

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### JOINT MEETING OF THE NEW YORK, PHILADELPHIA, AND BOSTON OBSTETRICAL SOCIETIES

*MEETING APRIL 10, 1928, IN NEW YORK CITY*

DR. CHARLES C. NORRIS and DR. R. A. KIMBROUGH, of Philadelphia, presented a paper entitled **Relaxation of the Anterior Vaginal Wall**. (For original article, see page 675.)

#### DISCUSSION

DR. STEPHEN RUSHMORE said that the impression made by Dr. Norris' paper was very favorable, because he has suggested some of the admirable characteristics of the old-time gynecologic plastic operating of which there is little at the present time. We think chiefly of the tediousness of some of the old operations which were backbreaking to the assistants and time-consuming for the patient and operator, but were characterized by a certain precision and exactitude which is often forgotten in gynecologic survey today. Too little attention is paid to what may be called the cosmetic effect of plastic operations in the region of the external genitals.

The most important of the conclusions of Dr. Norris is that in which he calls attention to the fact that in order to carry out a satisfactory plastic operation, it is necessary to know beforehand just what the condition is with which one is dealing. Stated in this form it is an ideal impossible of attainment in plastic opera-



tions on the anterior vaginal wall, because in practice we do not find those structures which are portrayed in the books of anatomy. They speak of the urogenital diaphragm as consisting of two layers of fascia and various muscles arranged between these layers, but when we come to operate on the relaxed anterior vaginal wall ten or fifteen years, perhaps, after the first childbirth, when there have been a series of six, eight, or even ten labors, we find a condition which does not at all resemble what the anatomist has portrayed.

The possibilities of injury in the anterior vaginal wall give an ample supply of possible changes. There may be dislocation of the vagina, a tearing away of the vagina from the other structures, the vagina itself in prolapse; there may be cystocele; there may be urethrocele without any particular relaxation of the sphincter of the bladder. More commonly there is cystocele with relaxation of the sphincter of the bladder and with a certain amount of urethrocele. In the stretching of the urogenital diaphragm with a certain amount of submucous laceration, the tissue may be torn away from the bone on one side or on the other, and a reef in repairing the anterior vaginal wall may be placed in the untorn part of the diaphragm and leave unsewed the part where the lesion has taken place. It is rather difficult to recognize sometimes just where the lesion has taken place, and if it has been symmetrically distributed and there is general stretching without much localized tearing, taking a reef is perhaps the best procedure, but is not to be considered very satisfactory from the point of view of exact surgery.

Dr. Norris used the term urethrocele as applying to a condition that perhaps could not be detected by ordinary clinical examination. Does it not tend a little to obscure the clarity of exposition to use the term in that way? Urethrocele, Dr. Rushmore assumed, strictly speaking means a tumor, swelling, or lump of the urethra or containing the urethra, and if we cannot detect it by the ordinary means, that term should not be employed.

One of the ways of dealing with relaxation of the sphincter is to take up the slack by reefing, sometimes with a Pezzar catheter in the urethra. We test the success of the operation by pulling on the catheter. If it comes out easily, we have not taken up much slack; if we cannot pull it out, we have taken up too much slack and have to do it over. It is a very clumsy test but in some cases it seems to be all we have to depend on except the postoperative function.

There is another condition which may be troublesome clinically, namely, hypertrophy of the anterior vaginal wall under the urethra, which, judged by the ordinary tests is not a urethrocele,—it does not contain mucous membrane of the urethra,—but it is the thing the patient feels, or rather, notices. If the redundancy of the anterior vaginal wall is not removed at the time of operation, the patient comes back six or eight weeks later and says that the prolapse of the uterus is recurring. On examination the uterus is found to be just where it was at the close of the operation and the anterior vaginal wall, except for this small area, just below the external meatus, does not protrude. But the patient is aware of something sticking out. It is a simple thing to take off under local anesthesia. It is, however, better to take it off at the time of the first operation.

There is one point that Dr. Norris makes which cannot be overemphasized, namely, that the operation should be fitted to the surgical condition. A typical operation is useless for an atypical condition. There is no single type of operation that we can apply to all conditions of the anterior vaginal wall, in the first place, because of the anatomic conditions which Dr. Norris has considered at such length; and in the second place, because of the age of the patient, the social condition, and various other factors. So we have to take into consideration these two things: first, to find out as exactly as possible before operating just what the condition is with which we have to deal. The x-ray would seem to be a very

helpful procedure, as portrayed by Dr. Norris, in helping us to find out the condition of the sphincter.

DR. R. M. RAWLS said that Halban and Tandler describe the muscles as the most important structures which support the pelvic organs; Edward Martin describes the fasciae as the all important structure and Robert Frank describes both of these structures as equally important. The latter assigns a fixing or holding function to the intracellular connective tissue and a supporting function to the musculofascial diaphragm.

The vagina pierces the urogenital diaphragm or triangular ligament and separates it into an upper and lower segment. The urethra pierces the upper segment and with the bladder is fixed or held in the anterior wall of the vagina by the intracellular tissues described by some anatomist as the visceral layer of endopelvic fascia, which is a division of the pelvic fascia. This fascia extends from the arcus tendineus of the pelvic fascia on either side to the urethra and bladder and from the cervix to the symphysis pubis. As the urethra passes through the urogenital diaphragm the compressor urethrae muscles and holding strands of connective tissue surround it.

In 1919, Joseph Halban clarified the anatomy by describing two independent sets of fasciae, i.e., an endopelvic fascia which is continuous with the endoabdominal fascia,—a thin, wide-meshed connective-tissue structure, which in the female pelvis becomes thick sheathed,—and an individual muscle fascia which is a division of the pelvic fascia. He holds that the most important structures in the support of the pelvic organs are the muscles and their individual fasciae.

Dr. Rawls agreed with many but not all of Dr. Norris' conclusions. Halban and Tandler and Edward Martin have shown that injury to the anterior wall, causing cystocele is most often between the cervix and bladder and posterior to the ureteric ridge and trigone. The former have also shown that urethrocele is due to injury to the anterior vaginal wall near the attachment at the symphysis which results in a sliding cystocele with urethrocele. Therefore a cystocele cannot by a dragging or pulling cause an injury to the vesical sphincter which is anterior to the ureteric ridge and the trigone, the most fixed points of the bladder, but the vesical injury and the injury resulting in urethrocele occurred at the same time as the injury causing the cystocele.

Dr. Rawls likewise did not believe that incontinence of urine can be due to urethrocele with a minor injury to the vesical sphincter. The test for incontinence of urine should be made with a full bladder and for urethrocele after the patient has voided. In the latter condition a dribbling of urine will then denote a urethrocele and residual urine in its diverticulum and not be an indication of a minor injury to the vesical sphincter.

Further, in his experience a funnel-shaped urethra in a cystogram does not always indicate a urethrocele or that other operative procedure than a cystocele operation is necessarily indicated. Dr. Rawls showed cystograms of 2 cases with a funnel urethra and neither had any subjective or objective symptoms of a urethrocele. In the postoperative cystograms there was a normal urethral shadow and in neither patient anything other than a cystocele operation was done.

Further, urethrocele and incompetent sphincter vesicae was not a common complication of cystocele in a series of cases at the Woman's Hospital. From Jan. 1, 1919 to Jan. 1, 1927, there were 1,035 operations done for cystocele and in 44 (4.3 per cent) there were urethroceles and in 53 (5 per cent) there were incompetent vesical sphincters.

DR. NORRIS (closing) said that when he used the terms internal sphincter and urethrocele, he was aware that these are doubtful terms. Some anatomists claim that there is no internal sphincter, but clinicians know that when this por-

tion of the urethra is relaxed, partial incontinence is likely to be present and when the relaxation of the proximal portion of the urethra is repaired, the incontinence ceases. He purposely employed the term urethrocele in order to call attention to the fact that the lesion which caused the incontinence was in the urethra and not in the bladder.

Dr. Rawls showed an x-ray picture which apparently showed sagging of the proximal portion of the urethra and in which there was a cystocele but no incontinence. They had this same difficulty in the first pictures. The floor of the bladder is a movable structure, and when a cystocele is present it naturally sags considerably. X-ray pictures can only be taken in one plane, and unless care is taken to secure the photograph from the proper angle, the lower portion of the cystocele will be found sagging down and simulating a relaxation of the proximal portion of the urethra when the plate is examined. In other words, in taking these pictures, a few of which were shown, care must be exercised to take the x-ray from a certain level and from the same angle in each case. If this is not done, variable pictures will be obtained. Dr. Norris said he had never seen a case of the type under discussion in which incontinence was present in which the relaxation of the inner portion of the urethra was not demonstrable.

Incontinence is probably the most frequent and annoying symptom of relaxation of the anterior vaginal wall. This usually manifests itself only upon sudden increase of intra-abdominal pressure, such as is produced by coughing or straining. It is generally due to a laceration or pathologic relaxation of the internal sphincter of the urethra and is a frequent accompaniment of cystocele. It is especially prevalent among stout women in whom the intra-abdominal pressure is probably considerably greater than in thin individuals.

# Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

## Collective Review

### Ovarian Irradiation\*

A REVIEW OF THE EXPERIMENTAL LITERATURE

BY LEOPOLD GOLDSTEIN, M.D., PHILADELPHIA, PA.

THE rays of radium and x-rays are known to produce definite structural and functional changes in the human ovary, and experimental studies indicate that similar results occur when animal ovaries are irradiated. This paper deals with experimental investigations previously reported in literature, and is concerned essentially with the histopathologic changes produced in irradiated ovaries.

The Gyneccean Hospital Institute of Gynecologic Research of the University of Pennsylvania, is at present investigating the effect of irradiation upon the ovary, with special emphasis upon the health of the progeny. This problem is being studied both clinically and experimentally. The clinical part deals with the health of the first generation of children, while the experimental study is concerned with the influences of irradiation on the *first and second generation of animals*. In order to obtain evidence that may be used as a basis on which to predict the growth and health of the progeny born of irradiated mothers, animal experimentation is being carried on. Observations are being made on white rats that were irradiated prior to mating. The health and development of the offspring of the first two generations are being studied, in order to detect any defect resulting from the previous maternal irradiation, and the ovaries of the irradiated rats are being examined for histopathologic changes.

The whole problem is important for two reasons: Therapeutic irradiation is now being used more and more frequently during the active reproductive period of women, and in a few instances, irradiated mothers have given birth to defective children. Some observers have attributed these defects to the irradiation.

The present paper is preliminary to the experimental study on defect production now under way. It has a twofold object: first, to learn what ovarian changes are possibly produced by irradiation, and second, to estimate the rôle played by the irradiation in altering the subsequent reproductive function of the animal, and in causing defects that may occur in the young of such animals.

All the recorded experimental studies on irradiation of ovaries have been reviewed and analyzed. Attention was paid particularly to studies in which the histopathology of the irradiated ovary was

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stressed. The experimental data and the microscopic findings have been tabulated and are presented in the accompanying tables. A general summary of all the experiments reviewed is shown in Table I.

### I. METHODS OF EXPERIMENTATION

*Source of Irradiation.*—The term irradiation as employed in this paper refers to the use of radium, of x-ray, or of mesothorium. The latter was used in only four cases. X-ray was employed in 33 experiments, radium in 13, while in 2 studies the exact nature of the agent was not described.<sup>10, 21</sup> The x-ray was the agent most frequently selected because of its availability and ease of application.

*Types of Animals Employed.*—As shown in Table I, rabbits, guinea pigs, mice, and rats were the most frequently used, in the order named. The influence that the type of animal may have on the ovarian response to irradiation will be discussed later.

*Dosages of Irradiation.*—A general statement cannot be made concerning the dosages of radioactive agents employed by the various workers because of the many and divergent methods of treatment. Practically every investigator used several different dosages of the agent in his effort to produce ovarian change. Much importance apparently was not attached to dosage by the authors who instituted researches on ovarian irradiation. The multiplicity in findings and results might possibly be explained on the divergence in dosages used. Details in treatment, other than the length of x-ray or radium exposure, such as type of filter used, distance of ovaries from irradiative source and method of application must be known in order to evaluate the dosage used. Since these details are lacking in many of the experimental reports, we have not discussed dosage, except to emphasize its importance in the results obtained. This importance is exemplified in the experiments in which a 5 per cent skin erythema dose (E.S.D.) of x-ray produced no ovarian damage, while a larger dose of 20 to 30 per cent E.S.D. caused severe damage.<sup>17</sup> In several experiments, 600 to 1200 milligram-hours (mgh.) of radium<sup>33, 34, 60</sup> produced slight effect, while in several others, 3000 to 5000 mgh. resulted in severe ovarian damage.<sup>12, 52</sup>

*Methods of Administration.*—There was apparently no plan common to the various observers in selecting the details of treatment in this group of experiments. The external application of x-ray was the method employed by practically all the investigators using this agent. In one set of experiments, the ovaries of the rabbit were x-rayed through an abdominal incision.<sup>4</sup> In the first method, the treatment was given over the ovarian sites, or in the case of a small animal, such as the mouse, the whole animal was exposed to the rays.

Radium and mesothorium were applied externally in most of the experiments and internally in a few. In one series of experiments, radium salt was injected intravenously.<sup>3</sup> In the external application, radium was usually placed over the dorsum, the loins, or over the abdomen of the animal. Several workers removed one ovary prior to irradiation in order to have a normal ovary for comparison with the irradiated one. Two workers, Forsdike and Schiffmann, applied radium directly to the ovaries through an abdominal incision. One investigator applied mesothorium intraabdominally in one case and externally in other experiments.<sup>33</sup>

*Time Intervals.*—The expression "time interval" refers to the period of time elapsing from the date of irradiation to the date of autopsy and removal of the ovaries for examination. Ovarian examination was made as early as three hours and as late as 209 days after irradiation. A few investigators autopsied all the animals and removed the ovaries for study on a selected day after the irradiation. Other workers killed only one or two animals on the day selected for commencement of the study and another every few days thereafter, until all the animals were autopsied. This method provided a series of time intervals for one series of experiments.

The time intervals apparently had slight effect on the ultimate findings in the ovaries. For instance, Reifferscheid<sup>45, 50</sup> found as severe changes in ovaries removed 209 days after irradiation as in those removed weeks earlier. Changes were reported occurring very shortly after irradiation. Reifferscheid reported degeneration as early as three hours after x-ray treatment. W. Müller<sup>37</sup> claimed that the changes observed by Reifferscheid shortly after irradiation were a part of the normal histologic picture. He also holds that changes do not appear until after a pronounced latent period. Forsdike, Matthews, Lacassagne and Specht in agreement with Reifferscheid report changes occurring within twenty-four to seventy-two hours after irradiation. The larger and longer exposures produced changes sooner than the smaller and shorter exposures.

## II. ANATOMIC AND PHYSIOLOGIC VARIATIONS IN THE NORMAL OVARY

In order properly to evaluate the effect of irradiation upon the ovary of any animal, it is extremely important to realize the peculiarities of structure and function of the ovaries concerned. We, therefore, will discuss important points in the anatomy and physiology of the ovaries of the animals most frequently used in the experiments. The characteristics of ovulation, interstitial tissue and corpus luteum in the rabbit, guinea pig, mouse, and rat are described. Considerations of the causes and mechanisms of estrous phenomena and physiologic relations of the follicles, corpus luteum, and interstitial tissue to such phenomena, are not within the confines of this discussion. For detailed studies of this topic, the reader is referred to the numerous works of F. H. A. Marshall, G. U. Papanicolaou, L. Loeb, L. Fraenkel, and J. Sobotta.<sup>56</sup>

*Ovulation and Estrous Cycles.*—It is well known that estrous phenomena and ovulation vary in certain animals. For instance, ovulation does not occur in all animals at each period of estrus. Spontaneous ovulation (i.e., without the added stimulus of sexual contact) occurs in the guinea pig and rat<sup>31</sup> and does not take place in the rabbit. According to E. Allen,<sup>1</sup> spontaneous as well as nonspontaneous ovulation is the rule in the mouse. Heape and Loeb<sup>10, 30</sup> found that the domestic rabbit does not ovulate until about ten hours after copulation. If the male is withheld at the time of estrus, the ova degenerate. If the doe is not mated after several consecutive estrous cycles, most of the older and younger follicles undergo degeneration and permanent sterility may result. Likewise, in some mice where ovulation is not spontaneous, the ovaries will contain no corpora lutea, but only atretic follicles and a few corpora lutea atretica as a result of the normal atresia.<sup>1</sup>

TABLE I. GENERAL SUMMARY OF EXPERIMENTS

AUTHOR	IRRADIATION	ANIMAL	INTERVAL	FERTILITY	FOLLICLES
					GRAAFIAN
Aschner (2)	X-ray	Dog, rabbit			Degenerated
Bagg (3)	Radium salt injection	Rat		Present	Missing
Bergonié, Tribondeau, and Récamiér (4)	X-ray	Rabbit	1 month		Degenerated
Bouin, Ancel and Villemin (5)	X-ray	Rabbit			Missing
Brambell and Parkes (7, 8)	X-ray	3 wk. old mice	1 wk. to 3 mo.	Sterile	Degenerated
		Adult mice	2 to 73 days	Present	Degenerated
Burckhard (10)	Irradiation	Rat		Present	Not affected
Driessen (11, 12)	X-ray	Rabbit		Present	Degenerated
Eymer (13)*	50 mg. radium, 70 hr. 48 mg. mesoth., 96 hr.	Guinea pig	28 days		Degenerated
Fellner (14)	X-ray	Rabbit			Degenerated
Forsdike (15)	50-100 mg. radium, ½ hr. 50-100 mg. radium, 2-7 hr.	Cat	36 hrs. to 84 days		Not affected Destroyed by 2-hr. dose
Fraenkel, M. (16)	X-ray	Guinea pig		Present	Cystic degen.
Geller (17)	X-ray 5 % E. S. D. X-ray 20-30% E. S. D.	Rabbit, rat	2 to 5 weeks		Not affected Degenerated
Halberstädter (18)	X-ray	Rabbit	10 to 15 days		Disappeared
Heimann (20)*	80 mg. mesoth., 12 hr.	Rabbit			Degenerated
Hüssey and Wallart (21)	Irradiation				Destroyed
Klein (22)	X-ray	Rabbit	6 weeks		Sensitive ones destroyed
Krause and Ziegler (23)	X-ray	Mouse	26 hours		Degenerated
Lacassagne (24)	X-ray	Rabbit	15 hr. to 4 da.		Degenerated at 14 days
Lengfellner (26)	X-ray	Guinea pig			Degenerated
Levant (27)		Rabbit	14 da. to 4 mo	Present	Degenerated
Massone (33)	Mesothorium	Guinea pig, rabbit			Degenerated
Matthews (34)	800 mg.-hr. radium 600 mg.-hr. radium	Guinea pig, and rabbit	4 hr. to 4-6 wk.	Present	Degenerated Not affected
Maury (35)	600 mg.-hr. radium	Rabbit	3 to 9 weeks	Present	Not affected in 12 ovaries
Müller, W. (37)	X-ray	Rabbit, mouse, guinea pig	2 to 3 weeks		Degenerated
Neumann (Quoted by 48)	X-ray	Rabbit			Degenerated
Okintschitz (40)	X-ray	Rabbit		Present	Degenerated
Plaut (44)	X-ray	Guinea pig			Degenerated
Reifferscheid (48)	X-ray	Mouse, monkey, dog	3 to 18 hours; 209 days		Degenerated
Robinson (51)	X-ray (170 E.S.D.)	Rabbit	2 weeks 3 weeks 6 weeks		Degenerated Degenerated Reappeared
Roulier (52)	X-ray	Rabbit, dog			Degenerated Not affected
Schiffmann (53)	6-15 mg. radium; 31 mg. mesoth., 4-21 days	Guinea pig			Degenerated
Serafini (54)	X-ray	Rabbit			Degenerated
Simon (55)	X-ray	Guinea pig, rabbit			Degenerated
Specht (57)	X-ray	Rabbit	24 to 72 hours		Disappeared
Steinach and Holzknecht (58)	X-ray	Guinea pig			Degenerated
Sugiura, Kanematsu, and Failla (59)	Ra. emanation 2.4 ml. curie hr.	Young mouse		Sterile	Destroyed
Tsukohara (60)	X-ray	Rabbit		Sterile	Degenerated
Weis (61)	600 mg.-hr. radium	Rabbit	Several weeks	Present	Not affected
Zaretsky (63)	X-ray	Rabbit			Degenerated

\*See text for variations produced by filters.

TABLE I. GENERAL SUMMARY OF EXPERIMENTS

FOLLICLES PRIMARY	OOCYTES	CORPUS LUTEUM	INTERSTITIAL TISSUE	GERMINAL EPITHELIUM	STROMA	VASCULAR CHANGES
Degenerated	Degenerated		Theca lutein cells in- creased			
Degenerated	Degenerated		Lutein cells degenerated	Degenerated		Sclerosis
Degenerated	Degenerated	Not affected	Theca interna degen- erated			
Degenerated	Degenerated		Increased			
Disappeared	Disappeared	None present		Proliferated	Atrophied	
Degenerated	Disappeared	Not affected	Theca interna hyper- trophied	Not pro- liferated	Hypertrophied	None
Not affected	Not affected		Not affected		Intact	
Degenerated	Degenerated	Not affected	Theca cells vacuolated	Degenerated	Degenerated	Hemorrhages
Degenerated	Degenerated					
Not affected	Not affected	Not affected			Intact	
Destroyed by 4-hr. dose	Destroyed	Increased			Intact	
Degenerated	Degenerated					
Not affected	Not affected		Well developed			Congestion, hemorrhages
Degenerated	Degenerated	Not affected				
Degenerated	Degenerated		Hypertrophied			
Destroyed	Destroyed		Hypertrophied			
Growth stimulated	Destroyed in mature follicles	Many present				
Degenerated	Degenerated					
Degenerated	Degenerated	Not affected	Increased			
Degenerated	Degenerated					
Degenerated	Degenerated		Increased after 2 mo.		Degenerated	Congestion
Degenerated	Degenerated	Not affected		Intact		Congestion
Not affected	Not affected	Not affected		Intact		
Not affected		Not affected		Intact	Not affected	None
Degenerated	Degenerated					
Degenerated	Degenerated					
Degenerated	Degenerated					
Degenerated	Degenerated	Not affected	Increased growth of theca		Degenerated	
Suppressed	Few degen- erated		Increased growth			
Increased		None found	Increased growth		Increased	
Normal	Normal	None found	Involuting			
Degenerated	Degenerated					
Not affected	Not affected			Intact		None
Degenerated	Degenerated					
Degenerated		No fresh cor- pus luteum	Growth stimulated	Intact		Congestion
Degenerated	Degenerated					
Degenerated	Degenerated	Not affected			Degenerated	
Degenerated	Disappeared		Theca and interstitial tissue increased	Intact		
Occasional fol- licle damaged	Degenerated					
Not affected	Not affected		Not affected	Intact	Intact	
Degenerated	Degenerated		Affected last			



Where ovulation is spontaneous (i.e., in the guinea pig, rat, and in some mice), three ovarian structures are involved: the follicles, corpora lutea, forming after ovulation, and possibly interstitial tissue. In the rat, the sexual cycle consists of the first or follicular phase dominated by the maturing follicles.<sup>31</sup> The luteal phase is lacking under ordinary conditions. In the rat and guinea pig, the estrous cycles are similar as far as the first phase is concerned. The second or luteal phase is present in the guinea pig, absent in mice that ovulate spontaneously and absent in the rat. The lack of influence of the luteal phase is shown in the two or three sets of corpora lutea of estrus that are present at all times in rats and to less extent in mice.

From this description, we can readily see how the normal follicular atresia occurring in the rabbit and in some mouse ovaries, and to a much less extent in rat and guinea pig ovaries may be misinterpreted for degeneration produced by irradiation.

*Corpora Lutea.*—According to Loeb<sup>30</sup> and Allen,<sup>1</sup> the corpora lutea in the mouse and rat do not prevent the maturation of follicles. In these animals, two or three sets of corpora lutea persist throughout a number of estrous cycles. This shows the inactive part the corpora lutea play in the production of estrus. The presence of persistent corpora lutea in the ovary of the guinea pig would inhibit maturation. That ovulation may be accelerated by the absence of corpora lutea was shown in experiments,<sup>41</sup> in which the removal of young corpora lutea in the guinea pig following ovulation called forth the next ovulation in eleven days, instead of eleven to seventeen days, as would normally be expected. The guinea pig ovary usually shows only a few fresh corpora lutea. In the ovaries where persistent corpora lutea are present, mature follicles would not be found. In the rabbit, corpora lutea formation, as was previously mentioned, does not occur unless copulation and subsequent ovulation take place.

The rôle played by the corpus luteum in the estrous cycle is seen to vary in the several animals. The findings in the corpora lutea after irradiation will be explained on the basis of the normal luteal development for that animal.

*Interstitial Tissue.*—Interstitial tissue development is most pronounced in the rabbit, where a periodic formation of the cyclic corpora lutea is lacking, and where the greatest amount of space is available for development of an interstitial gland. The guinea pig ovary has somewhat less interstitial tissue than the rabbit. In the rat ovary the theca interna development is much less than in the rabbit.<sup>29</sup> The normal interstitial tissue growth in rabbit ovaries takes on significance in the evaluation of those reports of increased interstitial cell growth as an effect of irradiation.

#### SUMMARY OF ANATOMY AND PHYSIOLOGY

1. Estrus occurs in the unmated rabbit without ovulation. Ovulation occurs associated with the estrous cycles only when copulation takes place. The estrous cycle phenomena are usually associated with spontaneous ovulation in guinea pig, rat, and in many mice.

2. Many atretic follicles and corpora lutea atretica are present in the rabbit ovary and in some mice. Small amount of atresia is present in guinea pigs, rats, and in many mice.

3. No corpora lutea are present in the young or unmated rabbit.

Many sets of corpora lutea are present in the ovary of the rat and in many mice. The guinea pig ovary contains a few fresh corpora lutea of estrus.

4. Interstitial tissue in the rabbit ovary assumes gland-like proportions, while this tissue development is much less in guinea pig, and least in the rat and mouse.

### III. HISTOPATHOLOGIC CONSIDERATIONS OF THE IRRADIATED OVARY

The histopathologic appearances of the irradiated ovary as described by thirty-nine observers are presented in Table I, irrespective of the methods, agents, dosages, and details of experimentation employed. All except seven of these authors report definite pathologic findings as a result of irradiation. Of these seven, only two, Weis and Burkhardt, report the entire absence of damage in the irradiated ovaries. The other five, Geller, Forsdike, Matthews, Maury and Roulier, describe some degenerative changes under certain conditions of experimentation which were not present under other conditions.

The microscopic changes and appearances in the ovarian tissues will now be presented under special headings. Effects of certain types of filters on the ovarian response to irradiation will also be described.

*Histopathology of the Oocytes and Follicles.*—A summary of the effects of irradiation on oocytes (ova), graafian follicles, and primordial follicles is shown in Table II. Oocytic and follicular damage was found in 78 to 83 per cent of the experiments. Damage to primary follicles was reported somewhat less often than to graafian follicles. It appears as though primordial follicles are capable of withstanding exposures that affect the graafian follicles.

*Ova Changes.*—The ova of the large and maturing follicles were affected first. It appears that the ovum is the most sensitive portion of the follicle. Klein<sup>22</sup> found changes occurred first in the cells of the zona pellucida. Sugiura<sup>60</sup> and Tsukohara<sup>60</sup> observed that the ovum and discus oophorus were the sites of earliest action. Brambell and Parkes discovered that all the small oocytes disappeared within two days after irradiation. Contrary to Klein, they found that the cells of the zona pellucida were persistent and remained as a mass in a small cavity long after the oocytes had degenerated and the follicles had ceased to exist.

The degenerative changes are found in the egg cells often long before the granulosa cells show changes. The nuclei of the ova present distinct degenerative appearances. They lose their round outline and the chromatin separates irregularly. The protoplasm of the ovum stains poorly and finally the entire cell disappears. Atrophy and desquamation of the flat follicular epithelium occur. Nuclear de-

TABLE II. EFFECT OF IRRADIATION ON OOCYTES AND FOLLICLES

	TOTAL EXPERIMENTAL		
	OBSERVATIONS	DAMAGE	NO DAMAGE
Oocytes	43	36 (83.7%)	7
Graafian follicles	46	38 (82.6%)	8
Primary follicles	46	36 (78.1%)	10

Table showing frequency of damage to oocytes, graafian follicles and primary follicles, resulting from irradiation of ovaries of animals, irrespective of types of animals employed or details of treatment.

struction of the granulosa cells takes place with a resulting shriveling of the follicular cavity. Brambell<sup>5</sup> observed the formation of "anovular" follicles from small follicles by degeneration of the ova and growth of the membrana granulosa cells.

*Follicular Changes.*—Twenty-nine x-ray experiments resulted in the production of damage to graafian follicles, and twenty-six in damage to primary follicles. Appearances other than degenerative were observed in the primary follicles in six cases. Two authors x-rayed animal ovaries with negative results in some experiments and positive results in others. Roulier<sup>52</sup> observed degenerative changes in the rabbit ovary, but none in the ovary of the dog. His explanation is that the ovaries were too distant from the source of irradiation.

Two reports of growth and stimulation of primordial follicles are included in the ten negative reports (see Table II) on primary follicles. Klein reported growth of young follicles after x-ray treatment, while Robinson reported the growth of young follicles subsequent to a primary "displacement or suppression." These authors likewise found degeneration of the ripe and maturing follicles.

Three observers found that 600 mgh. of radium did not injure the follicles. Weis,<sup>61</sup> working with rabbits, had no evidence to prove that ova and mature graafian follicles were affected. In 16 animals irradiated, the ovaries showed normal histology with follicles in all stages of development. Maury<sup>35</sup> concluded in his work on rabbits that a similar application of radium produced no degeneration, although he found degeneration of all large follicles in 11 ovaries. Matthews<sup>34</sup> reported that there were no characteristic pathologic changes in rabbit ovaries due to the action of radium rays up to 800 mgh., and that beyond this dosage the ovaries showed changes.

Severe microscopic alterations in the ovaries were described by Forsdike, Eymer, Sugiura, and Schiffmann after radium treatment. Forsdike found that 200 to 700 mgh. produced ovarian degeneration in cats, while Schiffmann<sup>53</sup> found degeneration after the application of 600 to 5,000 mgh. of radium in guinea pigs, and Sugiura<sup>50</sup> after 2.4 millicurie-hours of radium emanation in few-days-old mice.

Mesothorium produced follicular degeneration in all four cases where employed and apparently its action was similar to that of radium.

*Changes in the Corpora Lutea.*—The term corpus luteum as employed here refers to the cellular body produced in the ovary after rupture of the ripe follicle and expression of the ovum. We do not refer to the theca lutein cells that develop into the so-called interstitial gland tissue or "puberty" gland of Steinach and Holzkecht. The effect of irradiation on the theca interna and interstitial tissue is considered separately.

TABLE III. EFFECT OF IRRADIATION ON CORPORA LUTEA

	NUMBER OF OBSERVATIONS
1. No change	11
2. Degeneration	0
3. Absence	4
4. Increase in number	2
Total	17

Table showing resistance of corpora lutea to irradiation.

A summary of the effect of irradiation on the corpora lutea is shown in Table III. One can see that the number of reports is small compared with the entire number of experiments with irradiation. Radium or x-ray apparently produces slight effect on the corpus luteum, since pronounced degeneration was not observed. Lacassagne found the luteal cells very resistant to the x-ray. In 11 of the 17 experiments, no demonstrable effect could be found in this tissue.

We have attempted to explain the various findings reported in the corpora lutea on an anatomic or physiologic basis. The type of animal employed may explain the absence of corpora lutea in ovaries following irradiation. Three-weeks-old mice were used in one series of experiments and young virgin rabbits in the remaining four sets of experiments in which the absence of corpora lutea was observed. The absence of ovulation because of immaturity readily explains the lack of luteal tissue formation in the young mice and rabbits used. The nonoccurrence of spontaneous ovulation is the probable explanation of the lack of corpora lutea in unmated adult rabbits and in some mice.

An increase in the number of corpora lutea was reported twice. Forsdike<sup>15</sup> found numerous large corpora lutea in sections of the cat ovary in which the primary follicles were only partially destroyed. He believes these were derived from the undamaged primordial follicles that had matured rapidly after irradiation. An increased number of corpora lutea in the rabbit ovary was associated with a stimulation of the primary follicles in one case.<sup>22</sup> The influence of the maturing undamaged follicles may possibly explain the increased formation of corpora lutea here, because the irradiated animal was mated with a vasectomized male. Occurrence of ovulation after the stimulus of sexual contact would lead to the development of corpora lutea.

*Changes in Interstitial Tissue.*—By interstitial tissue is designated the tissue of an epithelioid character found between follicles consisting, not of connective tissue cells, but of cells resembling those in gland tissue. Changes in theca interna and interstitial tissue were grouped together because cells of both tissues have apparently a similar origin and were influenced similarly. According to Wilkerson,<sup>62</sup> physiologic atresia of follicles is antecedent of the so-called interstitial gland. In atresia of the follicles in the rat, mouse, and rabbit, the cells of the theca (particularly theca interna) become transformed into large polyhedral cells containing lipoid, and are really interstitial cells.

TABLE IV. EFFECT OF IRRADIATION ON INTERSTITIAL TISSUE AND THECA INTERNA

	NUMBER OF OBSERVATIONS
1. Hypertrophy .....	13
2. Degeneration .....	5
3. No effect .....	2
Total .....	20

Table showing power of irradiation to cause increased growth of interstitial tissue.

The important finding was the stimulation or increased growth of interstitial gland tissue. Table IV shows that increased growth of theca interna and interstitial tissue occurred in 13 of 20 experiments. It is an interesting coincidence that 9 of the cases of interstitial tissue hypertrophy were observed in the ovary of the rabbit. As was

previously mentioned, the ovary of this animal is normally the site of a large amount of interstitial tissue because of the normal atresia going on, especially in the unmated or young animal.

Aschner, Bouin, Geller, Klein, Levant, Lacassagne, Robinson and Serafini found that the hypertrophy of the interstitial tissue in the rabbit ovary was associated with the degeneration of the ova and graafian follicles. Two of the four observations on increased growth of interstitial tissue were made on the guinea pig,<sup>44, 58</sup> one on adult mice,<sup>8</sup> and in one observation<sup>21</sup> the type of animal could not be determined by the author. Two authors<sup>44, 58</sup> believe that a physiologic growth of theca interna occurred as a result of the rapid destruction of the ova cells, and follicular atresia and atrophy produced by irradiation. In the x-rayed ovaries of adult mice,<sup>8</sup> the interfollicular tissue hypertrophied together with the theca interna and granulosa cells, the growth of the latter two becoming indistinguishable from it.

Graafian follicles were damaged in all the cases where interstitial tissue underwent hypertrophy. Degeneration of primordial follicles was associated with hypertrophy of interstitial tissue in 11 of the 13 reports. In two instances, increased follicular growth occurred with increased interstitial cell growth.

Interstitial cell degeneration constituted a part of the general degeneration in four cases. One author reported that involution of the interstitial gland took place when the ovary had recovered from the effects of irradiation.<sup>51</sup>

The two instances where interstitial tissue was not affected occurred in ovaries not damaged by the rays.<sup>10, 61</sup>

*Changes in Germinal Epithelium and Stroma.*—Reference to Table I shows that the germinal epithelium is more resistant to irradiation than the stroma. The stroma was deleteriously affected in almost half of the experiments, while the germinal epithelium was damaged in only three cases. Brambell and Parkes<sup>7</sup> experimenting on three-weeks-old mice found pronounced proliferation of the germinal epithelium into cords resembling luteal cells.

*Vascular Changes.*—Few vascular changes were reported as a result of irradiation. Congestion, the most common finding, was reported four times. Bagg found sclerosis of ovarian vessels after intravenous injection of radium salt in rats.

*Effect of Filters on Pathologic Changes.*—That various filters influence the reaction of the ovarian tissues to irradiation was shown by Eymer<sup>13</sup> and Heimann.<sup>20</sup> The former irradiated rabbits over the abdomen with radium and mesothorium, and employed lead filters of varying thicknesses. He found that 50 milligrams of radium applied for seventy hours with filter of 4 mm. lead produced severe damage in all the ovarian tissues after a time interval of twenty-eight days (Table I). Application of 48 milligrams mesothorium, with 3 mm. lead filter for ninety-six hours produced a high-grade destruction in the ovaries examined immediately after irradiation. The theca cells were not as severely affected as with the 4 mm. filter. Application of 48 milligrams mesothorium with 2 mm. lead filter for one hundred and twenty hours, and for one hundred and forty-four hours, after intervals of nine and seven days respectively, produced practically no damage in the primary and smaller follicles. An exposure of 3500 mgh. of radium without a filter, after an interval of eight days brought about changes only in the graafian follicles. No changes were induced

in the theca, corpus luteum, primary follicles, germ epithelium, stroma and in ripe follicles. Eymer concluded from these results that the biologic activity of radioactive substances, filtered with lead, is greater than without filter, and that the length of exposure must be increased to get the same action on tissue without the use of a filter.

Heimann irradiated rabbits externally with 80 milligrams mesothorium for six to twelve hours employing filters of 1 mm. brass, 3 mm. aluminum and 3 mm. lead, and no filter in one case. With the lead filter he noticed definite ovarian degeneration while with aluminum, brass and without filter, he found none or very slight changes.

From these experiments it appears that the type of filter employed may also influence the degree of degeneration produced in the irradiated ovary as well as varying thicknesses of the same filter.

#### SUMMARY OF CHANGES

The histologic findings can be summarized and grouped, irrespective of the details of treatment, as follows:

*Negative Changes.*—In this class are included the few cases where the ovary was not injured by the irradiation. This result may possibly be explained on the grounds of insufficient irradiation, too long distance of ovary from irradiative source, influence of filters, or technic of treatment and examination.

*Degenerative Changes.*—Analysis of the large group of experiments in which ovarian damage was observed shows that the several tissues have different degrees of sensitivity to irradiation. Moderate to severe damage occurred in all the ovarian structures with the exceptions of the corpus luteum and germinal epithelium. Our study of recorded results corroborates in general the order from highest to lowest sensitivity described by Eymer<sup>13</sup> which is as follows: (1) nuclei of ova of the largest follicles, (2) ova cell protoplasm of largest follicles, (3) inner granulosa cell layer of large follicles, (4) ova and epithelial cells of young follicles, (5) outer granulosa cell layer of larger follicles, (6) primary follicles, (7) theca interna, (8) theca externa, (9) corpus luteum, (10) vessel endothelium, (11) rest of stroma and germ epithelium. This scale only considers the susceptibility of the tissues to the destroying effect of irradiation. That ovarian degeneration is brought about by irradiation cannot be denied, but the changes produced are not constant. Furthermore, the complex structure of the ovary with its physiologic atresia, as was pointed out, may interfere with the observer's judgment of the true histologic status.

*Proliferative Changes.*—They include: growth of primary follicles, growth of interstitial tissue, increased number of corpora lutea, and proliferation of germinal epithelium and stroma. The significance of growth in these tissues, with the exception of interstitial tissue, is not discussed because of the presence of only a few scattered reports on these changes. Growth of interstitial tissue was found in more than half of the observations on this tissue and was associated in all cases with degeneration of graafian follicles, and in almost all cases with degeneration of primary follicles.

#### IV. FUNCTIONAL CHANGES OF THE IRRADIATED OVARY

We believe, that the significance of ovarian damage lies in any functional disturbance that may be produced, and that one of the criteria

of the effect of ovarian irradiation may be obtained by a study of such functional disturbance, followed by histologic examination of the ovaries. For this reason, we are presenting some experimental evidence on fertility, estrous cycle production, restoration of function, and fertilization of ova after irradiation.

*Fertility in the Irradiated Animal.*—Only thirteen observations were made on the reproductive function of irradiated animals in which the ovaries were subsequently studied. Animals were fertile in ten experiments and sterile in three. Fertility was observed in animals with damaged ovaries, six times and with undamaged ovaries, four times. In six experiments, a number of animals mated became pregnant, although ovarian examination subsequently showed considerable degenerative changes. The results of a few of these experiments are presented in greater detail.

Brambell and Parkes<sup>8</sup> reported a series of experiments on x-rayed adult mice in which 75 per cent of the animals, killed more than five weeks after irradiation, had been sterilized. The criterion of sterility employed here was the absence of oocytes in the ovaries. Of the nine animals mated, four became pregnant following mating at two, four, six, and seven days respectively after irradiation. With one exception, the ovaries of these fertile animals were histologically unsterilized (i.e., well formed follicles were present). This exception was found in an animal mated at six days after irradiation that produced a normal litter of seven. The ovaries showed almost complete disintegration of the follicles and ova when examined sixty-seven days after irradiation.

M. Fraenkel<sup>16</sup> x-rayed a four-days-old guinea pig, and mated it at eleven weeks. He found cystic degeneration of the follicles in the ovaries after the animal had given birth to a litter of three, nine weeks later. The young remained backward in development, and the ovaries of the nonirradiated generation also showed follicular degeneration.

Lacassagne and Levant<sup>24, 27</sup> made microscopic examinations of the ovaries of 27 irradiated rabbits and found the follicular elements in a degenerated state. Lacassagne and Coutard<sup>25</sup> reported that of 51 young, born of previously irradiated rabbits, 29 died shortly after birth and the 22 lived but suffered severe intestinal disturbances.

Driessen<sup>11, 12</sup> mated rabbits several months after irradiation and autopsied them eight to fourteen days after mating. The ovaries in several of the animals showed follicular degeneration; the embryos showed delayed development. He concluded that irradiation produced germ plasm damage which expressed itself later in delayed embryonal development.

Okintschitz<sup>40</sup> irradiated nongravid mice, guinea pigs, and rabbits and observed them after mating. The mice became pregnant, but aborted; the guinea pigs died from the effects of irradiation; and the rabbits remained sterile. Microscopically, the ovaries of these animals showed disappearance of many follicles.

These experimental results point to the possibility of continuation of the reproductive function in the presence of partially damaged ovaries.

Experiments performed by Sugiura, Brambell, and Tsukohara resulted in permanent sterility of the irradiated animals. The ovaries

of these animals showed degeneration of ova and follicles. Apparently in these experiments, the effect of the irradiation was so severe that the reproductive function was permanently inhibited.

*The Estrous Cycle After Irradiation.*—It has been shown that the estrous cycle phenomena continue after x-ray sterilization in mice, even though there is complete obliteration of the cyclic ovarian structures.<sup>42</sup> Parkes believes that the cords of cells proliferated from the germinal epithelium are the source of estrin in the irradiated ovaries of young mice, and that the interfollicular tissue elements, having the germinal epithelium as their ultimate source, produce the estrin necessary for the estrous cycle production in adult mice.

*Restoration of Function Following Irradiation.*—The question how the restoration of ovarian function after a temporary cessation is to be explained, is of great interest. There are three possibilities by which this may be brought about:

1. Evidence presented by many authors points to the *growth of uninjured young follicles* as the most probable explanation for the re-establishment of ovulation. According to Fordsdike, Geller, Klein, Lacassagne, Levant, Pordes,<sup>43</sup> Maury, and Reifferscheid, young primordial follicles uninjured by irradiation, complete their normal growth to maturity.

2. According to Waldeyer,<sup>35</sup> the capacity of the germ epithelium to *renewal of follicle formation* is very improbable in extrauterine life.

3. *Regeneration of partially damaged follicles* was believed possible by Zaretsky and was denied by Reifferscheid. The latter, in order to learn if regeneration takes place, irradiated a series of mice and examined them months later. He found that degenerative changes persisted for months and observed no trace of regeneration.

*Fertilization of Ova Following Irradiation.*—Evidence showing fertilization of ova damaged by irradiation would throw light on the production of defects in the offspring. Unfortunately, we have only a few views on fertilization of the injured germ cell. Nürnberger<sup>39</sup> distinguished between phanetic cell injury which produces definite observable damage in the offspring, and genetic germ plasm injury which produces defects usually classed as hereditary. He pointed out that, from the morphologic appearance of the ovum, one cannot conclude concerning its biologic status, and believed that damage to ovary is only shown when no pregnancy follows, and if the germ cells are not damaged, then only perfect offspring will result.

F. Müller<sup>36</sup> believes in "all or none" in connection with injury to the sex gland. Either the germ cell is so severely damaged that fertilization is impossible, or if the germ cell is slightly injured and fertilization occurs, the product of conception will be healthy and not defective.

Mall<sup>32</sup> expressed the opinion that only rarely a destruction of the germ cell or impregnated ovum is the cause at the bottom of malformation. According to Mall, monsters are developed from normal ova due to external influences causing faulty implantation of the ova.

Bagg<sup>3</sup> concluded that irradiation of unfertilized ova may result either in completely destroying the functional activity of these cells, or so modifying their structure that the resulting offspring may be defective. According to Pemberton,<sup>43</sup> an ovum damaged by irradiation is not capable of fertilization, or if it is fertilized, probably results



in a damaged ovum which is aborted. Döderlein, Hirsch, and Ebeler (quoted by<sup>38</sup>) believed that the ovula were damaged by irradiation, and partly damaged ones produced malformed embryos.

The few experiments cited seem to show that animals may remain fertile, although the ovaries are damaged, and that the function of estrus may continue, although the animal is sterile. Evidence seems to point to the growth of young undamaged follicles as the probable explanation. The question of fertilization of the damaged ovum cannot be answered since there is no direct evidence and a disagreement in the views of the few authors mentioned.

#### DISCUSSION AND CONCLUSIONS

Because of the divergence and variation in the details of experimentation, such as dosage, filters, types of animals, and other points of technic, it is almost impossible to arrive at conclusions regarding many of the experimental researches which have been instituted. No standard for comparison of the results can be chosen because of these variables. Most of the investigations, however, agree as to the pathologic changes produced in the ovaries sufficiently irradiated, so that it may be taken as an established fact that certain histologic changes will be found in ovaries so treated.

Conclusions concerning radiative effects on the reproductive function are difficult to draw, because microscopic studies of the ovaries were not made in any of the experiments reviewed, with the exception of the few cited. In these, fertility was present although the ovaries were damaged. Many authors have reported conclusions on functional activities following ovarian irradiation that were not based upon ovarian examination. These reports have not been included in this paper because negative results may be explained on the ground of insufficient radiation, and functional disturbances on causes other than irradiation.

Our analysis of the experimental literature has disclosed that insufficient dosage and variations in ovarian sensitivity are factors that have resulted in the great divergence of results. Our own work has shown that it has been necessary to increase greatly the dosage which we first thought would sterilize, before any important functional changes were produced. The physiologic and anatomic peculiarities of the normal ovary may explain certain appearances that were observed after irradiation.

It seems to us that conclusions regarding the effect of ovarian irradiation must be based on the study of those animals in which definite functional disturbances are produced. We believe the most logical method and the one least open to error, consists in first carefully determining the dosage sufficient to produce definite functional changes and then studying them, comparing the ovaries of these animals, or of other animals treated with similar dosage, with a control series. Minute histologic changes should not be attributed to irradiation unless carefully controlled by functional alterations, because such changes may be explained by factors other than irradiation.

It is seen from our survey, that only a few authors studied the ovarian changes in conjunction with functional ones, so that little is known of the exact nature of the effect of irradiation. Further ex-

perimental investigation is necessary in order to learn the effect of irradiation on ovarian structure and function.

From our study of the experimental literature on ovarian irradiation, we may state that:

1. The animal ovary can be damaged by sufficient exposure to radium, x-ray, or mesothorium.

2. There is apparently some stimulation of the interstitial gland tissue of the ovary which may be physiologic or a result of follicular degeneration.

3. There is some evidence that animals may retain their fertility even though the ovaries have undergone distinct degenerative changes.

4. No evidence is available to show that damaged ova were responsible for the pregnancies occurring after irradiation.

5. We believe, that the exact nature of the effect of ovarian irradiation can only be understood by studying any functional disturbances that arise after irradiation, in conjunction with pathologic changes in the ovary.

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## Selected Abstracts

### Miscellaneous

**Lundh, G.:** On the Problem of Age and Primiparity. Acta Obstetrica et Gynecologica Scandinavica, 1926, iv, 137 (Suppl.).

The principal results of this elaborate study concerning 7621 primiparae ranging in age from 13 to 47 years, may be summarized under the following main heads:

The time of the onset of the first menstruation postpartum shows a regular postponement with increasing age at the first parturition, although to this delay in the appearance of the flow no great importance can be attributed, owing primarily to the unreliability of the patients' statements regarding this time.

With reference to morbidity during pregnancy, it is only the toxemias which show a moderate increase for the oldest patients and possibly a slight increase for the very youngest.

The frequency of premature labor is highest among the youngest women.

There is a definite optimum for the duration of labor around the twenty-second year with a range on either side of two or at most three years, so that from this point of view the most suitable time for a first labor coincides with a period lasting from the nineteenth up to and including the twenty-fifth year. After the latter year labor lengthens progressively with advancing years, and this fairly uniformly. In the very youngest there is also a prolongation of labor, rising with increasing years. The rise here seems to be less dependent upon the degree of complication of the labor.

Certain evidence as to the cause or causes of this proved prolongation with age can scarcely be procured through a statistical investigation. Judging from the records in the case-sheets, a number of complications more or less unfavorable to the course of labor may certainly be considered as commoner in elderly primiparae; e.g., contracted pelvis, anomalous fetal presentation, premature rupture of the membranes, etc., though these conditions cannot be regarded as the actual causes of the prolongation of labor with advancing age. Inadequate pains associated with rigidity of the soft parts, as an expression of a retrogressive age change of the uterine musculature in the women who do not become pregnant until a considerable time after the advent of puberty (disuse atrophy), may be assumed to be the principal cause of prolongation of labor.

Among the other complications of labor it is chiefly eclampsia that shows a definite increase in the elderly classes and to some extent also in the youngest.

The frequency of all varieties of operative interference as also of perineal lacerations shows a marked rise with advancing age, and is without exception lowest among the very youngest classes.

There is a prolongation of the placental stage in the elderly, and the number of interventions in this stage of labor shows a considerable increase with rising age. The youngest mothers also show a slight prolongation of this stage.

Age does not seem to exercise any influence whatever upon the weight, length, and head dimensions of the children; nor does it appear to influence the sex of the children. The frequency of twins increases with maternal age.

Infantile morbidity and mortality both show a great increase with rising maternal age.

The maternal morbidity in the puerperium shows no definite influence of age. As regards the mortality, a certain influence of age cannot be excluded, especially in respect to deaths in eclampsia.

The proved increase with years in the risks encountered by a primipara appears to manifest itself to a still higher degree in women who have been married a rather long time before becoming pregnant.

J. P. GREENHILL.

Küstner, H.: Increase in Obstetric Complications During the Last Few Years. *Monatsschrift für Geburtshilfe und Gynäkologie*, 1927, lxxv, 524.

During the last few years, there has been an increased incidence in the cases of contracted pelvis in Germany; but this complication can be recognized early and hence, properly treated. More important, however, are the complications which may arise suddenly and one of the most serious of these is postpartum hemorrhage. Küstner reviewed the case reports of 25000 women who were delivered in the Leipzig clinic between 1911 and 1926. Among these women, 1550 lost more than 600 c.c. of blood. From 1924 to 1926 the frequency of postpartum hemorrhage among young women was between two and three times as great as it was from 1911 to 1923. The author believes that the cause of this is the damage to the genital organs which occurred during the war as the result of undernourishment. The author had previously found a great increase in the incidence of genital hypoplasia in women who were at the age of puberty during the war. When these girls reached adult life, the hypoplasia was either so extensive that sterility was the result or abortions occurred, or the hypoplasia was mild in which case atony of the uterus or postpartum hemorrhage occurred.

A second interesting fact was that during the years of the war, there was an increased occurrence of postpartum hemorrhage among older women and this increase rapidly disappeared after the war. The marked frequency of hemorrhages during the war was due to undernourishment during pregnancy.

From these studies the author concludes, first, that undernourishment during the years of development produces a weakness in the genital apparatus which may later cause postpartum hemorrhage, and secondly, undernourishment during pregnancy and shortly before pregnancy in elderly women may produce an insufficiency in the genital apparatus which may cause weak uterine pains and hemorrhage.

J. P. GREENHILL.

Grosse, A.: Two Observations of Acute Dilatation of the Stomach after Delivery. *Bulletin de la Société d'Obstétrique et de Gynécologie*, Paris, 1928, No. 6, p. 547.

Acute dilatation of the stomach is a common occurrence in surgery, but it is very infrequent in obstetrics. In the latter it may be observed not only after cesarean section but also following vaginal deliveries, normal as well as oper-

ative. The author reports two cases of this complication which occurred after delivery from below. He was able to collect from the literature of the last few years 19 additional cases. Among the 21 cases, 8 followed a cesarean section, one occurred after a Porro operation for rupture of the uterus, two were in eclamptic patients who had received a large amount of chloroform, six followed operative deliveries through the natural passages and four were noted after a spontaneous delivery. Hence more than half of the cases of acute dilatation of the stomach found in obstetric patients occurred after vaginal and not abdominal delivery. One of the author's cases was cured by gastric lavage, and the other by placing the patient on her abdomen.

The cause of the dilatation is a reflex paralysis of the stomach due to a variety of conditions such as postoperative or puerperal infection, the toxic action of anesthetics especially chloroform, abdominal trauma in dystocic labor, and above all a difficult version and extraction, attempts to forcibly express the placenta, and changes in abdominal equilibrium following evacuation of a large uterus. In nearly all the patients who develop this condition there is a predisposing condition.

J. P. GREENHILL.

**Buist, R. C.: Posture in Difficult Labour.** *British Medical Journal*, 1924, No. 3319, p. 226.

Most of the devices by which we reduce the difficulty of labor have been practiced, at least in kind, for thousands of years.

A "hanging leg" posture was described and figured by Scipio Mercurio at the end of the sixteenth century, but, though he mentions compression and checking of the bones of the pelvis as a source of difficulty, he did not recognize the position as specifically adapted to that difficulty, but to labor that is difficult "from what cause you will."

The distensibility of the symphysis pubis in pregnant women was long a subject of dispute. Ambroise Paré and Severinus Pinæus separately report their presence in 1579, at the autopsy of a woman of twenty-four years, who had been hanged for child murder ten days after her delivery.

It was not recognized that this mobility of the bones could be called upon by the posture of the patient to reduce the difficulty of labor in a narrow pelvis until in 1889 Walcher reported that in six cases, by putting the woman with a cushion under her sacrum and her legs hanging, he had secured an increase of from 8 to 13 mm. in the conjugate diameter of the brim.

Obesity was recognized by most of the ancient writers as a source of difficult deliveries. Mercurio discusses it at some length and recommends: (a) reduction of the diet by a third during the last two months of pregnancy, thus forestalling Prochownik; (b) medicines; (c) posture; (d) manipulation. The posture which is described and illustrated is an exaggeration of the hanging leg posture, such that it has been ridiculed as scarcely tolerable even for an acrobat.

The position which the ancient writers prescribed for the delivery of obese women was that on knees and face. This can be traced from Soranus, through Aetius, on to Eucharius Rösslin.

In practice, the hanging leg posture has proved so irksome to the patient that it has not always been possible to maintain it for a sufficient time. The knee-face posture is much easier, as is obvious from its being so often spontaneously adopted.

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## Original Communications

### OBSERVATIONS ON BLOOD SUGAR AND SERUM CALCIUM IN RELATION TO LACTATION IN WOMEN, WITH A STUDY OF ITS POSSIBLE RELATIONSHIP TO PARTURIENT PARESIS

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#### GENERAL INTRODUCTION

AMONG the many theories that have been brought forward to explain the etiology of "eclampsia" there has been one of mammary origin. Certain clinical similarities (convulsions, coma, albuminuria) between "milk fever," or parturient paresis, in cattle, and the toxemias of later pregnancy in women, similarities extending even to method of treatment up to 1897 (purgation, venesection, hot packs) led to a comparison of the two conditions. The discovery in 1897 by Schmidt,<sup>1</sup> that so simple a procedure as the injection of a small amount of potassium iodide solution into the udder (a process afterward improved by its inflation by air by Anderson<sup>2</sup>), led to a reduction in the mortality of "milk fever" in cattle from 40 to 50 per cent down to 1 to 2 per cent, could not fail to have a repercussion in human obstetrics at a time when the mortality from "eclampsia" was still distressingly high. Thus, despite dissimilarities (relation of occurrence to parturition, relation of incidence to parity) there were not found wanting obstetricians who applied the procedure of mammary insufflation, and even mammary ablation to "eclampsia" in women, unfortunately without the almost uniformly happy result attained by their brethren in veterinary practice. Wilson<sup>3</sup> in 1913 gave an excellent

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summary of those procedures up to that time. Since then theories of the mammary origin of "eclampsia" have fallen into disuse, though there are not wanting investigators who still believe that the theory may prove of assistance. Thus Kosmak<sup>4</sup> believes the subject may still prove worthy of study. Greig and Browne<sup>5</sup> have been experimenting on simple and efficient means of inflating the human breast. Our own reason for reviving the comparison is that recently there has occurred a recrudescence of experimental work on the condition in cattle, a review which, together with a study of the possibility of analogous conditions in women, may prove of interest to both branches of practice. Recent theories which have been proposed on the origin of parturient paresis in cattle are (a) disturbance in carbohydrate balance as exemplified by blood-sugar estimations, (b) guanidine intoxication consequent on parathyroid deficiency, (c) disturbance in level of blood calcium. It would be natural to connect the two latter theories, though they were proposed separately by their respective authors. At the onset it should be understood that "milk fever" in cattle is not per se attended by rise in temperature. A sub-normal temperature characterizes the condition. In many cases a raised temperature is observed, but this is generally ascribed to a concurrent infection. Also it is the general well-confirmed observation that "milk fever" is a disease attacking heavy-milking cows. It is usual to ascribe the success of the therapeutic mammary insufflation to the suppression of milk flow.

#### BLOOD SUGAR IN LACTATION IN COWS

The experiments of Porcher, Foa, Kaufman and Magne, and Cary as reviewed by Meigs<sup>6</sup> form strong evidence that the lactose of milk is formed from the glucose of the blood. A review of the level of blood sugar in lactating as compared with nonlactating cows shows a much lowered level in the former. In Table I, we have collected some of the results in the literature bearing on this point. The difference between the two states in the same species is marked except in man, and it is a reasonable assumption that the lowered blood glucose observed in the lactating animal is due to the demand on that sugar for the formation of lactose. Widmark and Carlens have calculated that a cow giving 28 kg. milk per day is under the strain of regenerating the whole of its circulating blood glucose every fifteen minutes. They have also endeavored to show that the level of the blood sugar is inversely as the intensity of the lactation. Table II, copied from their own paper,<sup>7</sup> is given as evidence of this assertion. In this connection too we may draw attention to the observation of Markowitz and Simpson<sup>14</sup> on the hypoglycemia observed in a totally depancreatized dog twenty-four hours after parturition. The amount of insulin which was sufficient to maintain a normal circulating glu-

TABLE I. SHOWING THE EFFECT OF LACTATION ON BLOOD SUGAR IN COWS, ETC.

SUBJECT	OBSERVERS	GLUCOSE, MG. PER 100 C.C.
		BLOOD, MG.
Cow (Dry)	Widmark and Carlens <sup>7</sup>	Av. 80
Cow (Lactating)	Widmark and Carlens	Av. 60
Cow (Dry)	Auger <sup>8</sup>	90-120
Cow (Lactating)	Auger	55- 75
Cow (Lactating)	Hayden and Sholl <sup>9</sup>	Av. 52
Goat (Dry)	Auger <sup>8</sup>	70-100
Goat (Lactating)	Auger	55- 65
Man (Normal)		80-120
Woman (Pregnancy)		80-120
Woman (Postpartum 7 days)	Bergsma <sup>10</sup>	Av. 94
Woman (Postpartum 7 days)	Morriss <sup>11</sup>	Av. 109
Woman (Postpartum 2 days)	Rowley <sup>12</sup>	Av. 140
Woman (End of labor)	Caldwell and Lyle <sup>13</sup>	Av. 95

TABLE II. SHOWING THE RELATION OF BLOOD SUGAR TO MILK YIELD IN DAIRY COWS ACCORDING TO WIDMARK AND CARLENS

COW	DAILY MILK OUTPUT	AVERAGE BLOOD SUGAR PER CENT
	KG.	
A	18	0.053
B	14	0.057
C	10	0.057
D	8	0.058
E	6	0.061
F	0	0.076
G	0	0.081

cose in pregnancy was insufficient during lactation. If these are the facts connecting the output of milk and the level of the blood sugar it requires very little effort to imagine circumstances in which a high milk-producing cow might lower the blood sugar to such an extent that the clinical manifestations of hypoglycemia would make their appearance. Such is the theory of etiology of parturient paresis as proposed by Auger<sup>8</sup> in France. Widmark and Carlens<sup>15</sup> in Denmark and Maguire<sup>16</sup> in England have independently proposed theories of hypoglycemia as the origin of "milk fever." All three have shown the occurrence of blood sugar lowered to symptomatic levels in "milk fever" in support of their claims and have claimed the rapid cure of the clinical condition by the injection of glucose solutions. Widmark and Carlens, and Auger have produced hypoglycemia in lactating cattle by insulin, and noted its similarity to parturient paresis. Although we have given in logical sequence a series of steps by which it might be assumed that hypoglycemia was the cause of "milk fever" in cattle, actually the possibility of a relationship between the two was pointed out from the similarity of the clinical symptoms in cows, and those of insulin hypoglycemia in rabbits, by an unknown Canadian veterinarian, who employed intravenous glucose solutions for its relief. This was reported by Neefs.<sup>17</sup>



The origin of parturient paresis in cattle which we have just presented has not escaped challenge. Little and Keith,<sup>18</sup> Hayden,<sup>19</sup> and Fish<sup>20</sup> have all failed to observe hypoglycemia in this condition. The findings of Hayden and Sholl, and Hayden, in particular, point to a hyperglycemia. Nevertheless the theory of hypoglycemia as the etiologic factor in milk fever is a powerful influence in veterinary practice.

Is there any analogue to be found in human obstetric practice? In this connection it is of interest to note the recent publication of Titus<sup>21</sup> claiming the presence of a relative hypoglycemia in "eclampsia" in women, to which the convulsive attacks should be ascribed, and reemphasizing his views on the value of intravenous glucose solutions in this condition. It is more usual to view "eclampsia" as accompanied by hyperglycemia. As far as lactation is concerned the level of blood sugar in women is usually regarded as similar to the pregnant or nonpregnant; i.e., 80-120 mg. (Table I). Such figures, however, do not take into account the probability of a decreased blood sugar due to excessive lactation similar to that claimed as occurring in cows by Widmark and Carlens. We have carried out a series of observations to this end, correlating the level of the blood sugar and the milk production.

#### THE TWO HOUR LACTATION TEST

In order to estimate the milk production of a series of women we devised a procedure which we have called the "two hour lactation test." The breasts are exhausted at 7 A.M. by an electric breast pump and again at 9 A.M. No food or water is given during this period, and the patient has fasted from the previous evening's meal. The amount of milk collected from 7 A.M. to 9 A.M. is taken as the "two hour lactation test" for the day. This is repeated on two successive mornings, and the average of the three measurements is taken as an index of the milk producing capacity of the subject. The test shows daily fluctuations but these are not usually large. Table III shows the ordinary fluctuations encountered in a number of cases. Repeated tests on three or four cases showed a similar average. Occasionally a case was encountered where the fluctuations greatly exceeded the general average fluctuation. This was encountered in women whose knowledge of English was insufficient to enable them to understand the procedure about to be carried out, and who were apprehensive of its effect. This usually disappeared on the second or third morning of the test. Occasionally, also, the effect of some external disturbance, usually of a family nature, the news of which was brought into the hospital by a visitor, made itself evident on the milk output. These emotional fluctuations were discounted in the final average. Examples of these are shown in Table III. All tests were carried out on the tenth, eleventh and twelfth day postpartum. All

TABLE III. ILLUSTRATING "TWO-HOUR LACTATION TEST"

SUBJECT	GRAVIDA	AGE	HEIGHT FT.—IN.	WEIGHT LB.	MILK OUTPUT				AVERAGE PER SQ. METER
					1	2	3	AVERAGE	
					c.c.	c.c.	c.c.	c.c.	c.c.
P-n	ii	18	5—4	142½	55	55	55	55	32.7
M-n	ii	30	5—4½	143½	75	50	40	55	32.5
M-n	ii	18	4—11	95	20	40	10	23	12.5
S-e	i	19	5—2	108½	20	10	15	15	10.1
P-r	iii	27	5—3½	115½	20	25	20	21	14.1
C-m	i	22	4—9½	106½	40	45	35	40	28.9
P-r	i	27	5—2½	102½	45	30	50	41	28.6
B-g	i	24	4—8½	118½	40	50	80	56	30.3
K-y	iii	26	5—3	109	30	30	25	28	19.1
W-s	v	24	5—4	122½	15	15	0*	15	9.9
S-l	ii	21	5—3	165	30	25	45	33	18.8
P-g	i	24	5—4½	127½	25	25	30	26	16.5
M-n	iv	33	5—2½	120	55	75	50	60	38.9
B-m	iii	25	5—3	128	45	40	65	50	31.4
Mc-y	iii	30	4—11½	105½	75	70	62	69	48.2
S-y	i	18	5—1½	110	5	7	10	7	5.0
P-s	i	30	5—2	127	5	7	20	10	6.7
P-s†	i	30	5—2	127	15	15	15	15	9.5
D-f	i	23	4—11½	101½	10*	3*	50		
S-l	ii	21	5—3	111	50	10*	50	50	33.3

\*Emotional Fluctuation.

†Repeat 10 days later.

cases were normal, developing no complications during the puerperium and receiving the same general diet. This ensured as equal conditions for the test as we think could be secured in a general maternity hospital. All tests were carried out under the supervision of one graduate nurse.

In order to equalize the possible effect of differences in weight, etc., on the milk-producing capacity of the subject, the average results of the two hour lactation test were corrected to the unitary standard of one square meter of surface area. The surface area was calculated from the heights and weights of the subject taken on the last morning of the test (Table III) using the Aub-Dubois table.

In Fig. 1 is shown the percentage occurrence of women according to their milk producing power as shown by the two hour test per sq. meter, with the milk producing power given in units of 10 c.c. The general average secretion of milk varies from 10 to 40 c.c.; 130 subjects were examined and 93, or 71.5 per cent, lie between these figures; 17 subjects, or 13.1 per cent, secreted below 10 c.c. A small group of 20, or 15.4 per cent, would evidently be considered as high milk producing women, giving over 40 c.c. of milk per square meter surface per two hours. According to our test the women would thus divide themselves into three groups of low, average, and high milk producers. The rather wide range of milk secretion of the average group is a result probably of the effect of various physical factors in the individual women. The large number in this group gives us confidence in

our average analytical findings in the blood specimens. On the other hand it diminishes to a rather small figure the number of women in the low and high lactating groups.

It is pertinent to inquire, however, whether the two hour lactation test is an accurate or even an approximate reflex of the lactating powers of the subject. Were the mammary gland a machine, and working with machine-like exactitude, we might expect the two hour test to represent one-twelfth of the twenty-four hour milk production. In general, this seems to be so, for the average value of the ratio of the two hour test to the twenty-four hour output (ratio  $\frac{b}{a}$ ) is 11.55 (Table IV) for the 60 cases studied. Individually, other factors,

SHOWING THE DISTRIBUTION OF WOMEN  
ACCORDING TO TWO HOUR LACTATION  
TEST PER SQ. METRE SURFACE

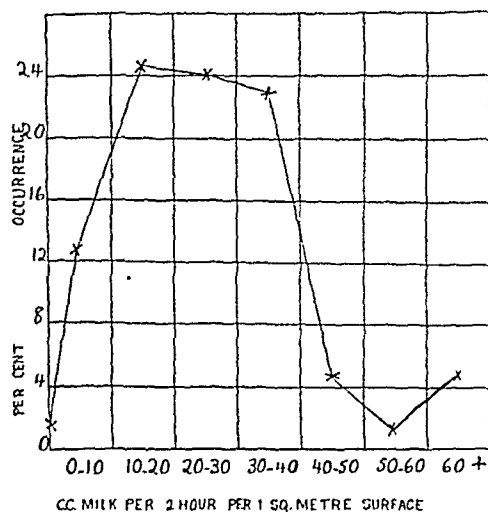


Fig. 1.

particularly those of emotion, etc., easily destroy this relationship. The ratio  $\frac{b}{a}$ , however, is not constant for the different groups of lactating women. In general, however, the woman who shows a low two hour lactation test shows a low twenty-four hour output. The average two hour test corresponds to an average daily output, etc. This is shown in Table IV, arranging the observations according to the two hour test in units of 10 c.c. (The figures in this table are shown as actually obtained and not reduced to 1 sq. meter surface.) The striking feature of these observations is the gradually decreasing value of the ratio  $\frac{b}{a}$ . The twenty-four hour output was determined on the tenth day postpartum commencing with the two hour test, weighing the baby before and after each nursing, and then measuring the milk exhausted from the breasts at 7 A.M. of the eleventh day

postpartum. In this way the full twenty-four hour output from 7 A.M. on the tenth day to 7 A.M. on the eleventh day postpartum was obtained. Such a determination involving a number of separate weighings on hospital scales should be susceptible to a greater number of errors than the two hour test. The regularity of the ratio  $\frac{b}{a}$  as shown in Table IV, however, convinces us that both sets of observations are substantially correct. What is the explanation of the decreasing ratio  $\frac{b}{a}$  with the increasing two hour lactation? How regular this decrease is may be seen if the ratio  $\frac{b}{a}$  is plotted against the two hour lactation test as shown in Fig. 2. The smoothed curve as drawn is so

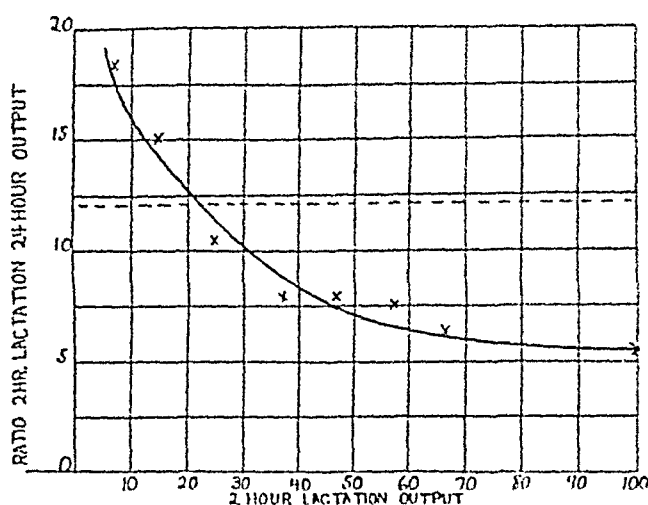


FIG. 2.

regular that one cannot help but suspect some biologic relation. A hint of what perhaps this may be is given if we suppose that the low lactating woman is under a greater stimulus to milk production than the high lactating woman. The two hour lactation test represents what should be a constant stimulus to all classes of lactating women.

TABLE IV. RELATIONSHIP OF TWO HOUR LACTATION TEST AND TWENTY-FOUR HOUR OUTPUT OF MILK

a	b	NO. OF OBSERVATIONS	RATIO $\frac{b}{a}$
AVERAGE 2 HR. TEST	24 HR. OUTPUT		
c.c.	c.c.		
7.3	137	1	18.7
15.2	225	9	15.1
24.2	281	10	11.7
34.1	301	8	8.8
42.7	353	13	8.2
53.4	416	11	7.7
65.1	447	5	6.8
118.2	657	3	5.4
Average ratio $\frac{b}{a}$ for total of 60 cases			11.55

It represents the ability of the gland to produce milk after the breasts have once been emptied. This, however, represents what is happening daily to the low milk producing woman. The suckling of the baby exhausts, or nearly exhausts, the breasts at each nursing. The glands are thus periodically stimulated to their maximum, or nearly so, several times during the twenty-four hours. With the high lactating woman, this is not so. The baby by no means exhausts the breasts at each feeding, leaving some milk in the gland to act as an inhibitory factor to its activity.\* The twenty-four hour milk output of the high lactating woman thus by no means represents the maximum capacity of glands. The two hour test gives a much better index. Even this is probably low, on account of the inhibitory effect we have just mentioned. Luckily our results of the blood analyses of these women are such that it is unlikely any error is introduced by this factor. If the explanation we have given of the variation in the ratio  $\frac{b}{a}$  is correct it forms another example of the beautiful adaptation existing between the milk supply of the maternal organism and the need of the young. The low lactating mother, stimulated by the periodic emptying of her breasts by the nursing infant, maintains a relatively high output while the high lactating mother, stimulated to a lesser degree by the partial exhaustion of her glands, reduces her output. It is of interest to observe that this regulation is already in operation by the tenth day postpartum.

#### BLOOD SUGAR AND LACTATION IN WOMEN

Arranging our cases in this way into three classes of lactation we have determined the average blood-sugar value of each group as shown in Table V. The blood specimen for analysis was taken fasting the morning of the tenth day postpartum. The plasma was separated immediately, oxalate being used as an anticoagulant. Sugar was determined by the method of Shaffer-Hartman.<sup>22</sup> A specimen taken on the eleventh or twelfth morning agreed with that taken on the tenth morning. The blood-sugar values of 95, 95, and 93 mg. for the three lactation classes scarcely show any variation, especially when the small number of cases examined in the low and high groups is considered. The average value of 94 for all cases agrees with the average figures of Bergsma (90 mg.) and Caldwell and Lyle (95 mg.), and is slightly lower than that of Killian and Sherwin (111 mg.). It is, however, much lower than that of Rowley; indeed Rowley's average figure of 140 mg. is distinctly high. The range of our blood sugars, 56 to 146 mg., represents a wide range but 85 per cent of our figures fall in the usually accepted range of 80 to 120 mg. There appears little evi-

\*Incomplete stripping in the milking of dairy cows is well known to lessen the yield.

TABLE V. CONNECTING THE AVERAGE BLOOD SUGAR LEVEL WITH THE LEVEL OF LACTATION

LACTATION GROUP	NO. OF CASES	BLOOD SUGAR AVERAGE 100 C.C. PLASMA	BLOOD SUGAR RANGE. 100 C.C. PLASMA	BLOOD SUGAR TOTAL AVERAGE
		mg.	mg.	mg.
*Low	16	95	72-138	95
Average	93	95	62-146	
High	21	93	57-122	

\*Variations in the number of cases occurring in a particular lactation group will be noticed. This is due to the fact that more than 130 subjects were examined, but it was not possible to obtain full data in each case.

dence, then, from our figures that lactation in women is attended by any carbohydrate or endocrine disturbance, such as is shown, in cows or goats, by the average low blood sugar. Tables VI and VII further emphasize this point. In Table VI we have collected together 8 cases whose blood sugar was 75 mg. or less. The range of these cases, 56 to 75 mg. blood sugar, is distinctly below the usual range. The lactation tests show, however, that only one out of the 8 would be classed as a high lactating woman, whereas 3 would be put in a subnormal class from the point of view of milk production. In Table VII we show the 5 highest lactating women of our series. The blood sugars of all lie well within the normal range. It is interesting to note, however, that were we to rely exclusively on the data of Table VI we might come to a different conclusion. The lowest blood sugar in Table VI corresponds to the highest lactating women and the three low lactating women are to be found among the four with the highest blood-sugar values, thus pointing to a connection between the extent of lactation and the level of the blood sugar. Such a conclusion could not be maintained in face of the evidence of Table VII nor from the general average figures of Table V. Such a demonstration illustrates, however, the danger of conclusion from a small amount of data. Indeed, in this connection we feel that the number of cases in our low and high lactating groups is small, and that we could not have drawn conclusions of a positive nature connecting the amount of lactation and the level of the blood sugar, even had our figures been in the right direction. It is only the fact that our blood-sugar values for the two extreme groups agree so remarkably well with our large average group, that makes us confident in drawing a negative conclusion. This lack of parallel in blood sugar variations between the lactation of woman and that of a highly specialized animal like the dairy cow may represent, however, no fundamental difference in the process itself. The difference may be merely that of degree. To what extent, then, does the milk yield of the group of high lactating women compare with that of the dairy cow? For purposes of comparison we may take Case H-r-f as shown in Table VII. This subject stands out over all the others as a milk producer. Her average production per

TABLE VI. SHOWING THE LACTATION OF A GROUP OF WOMEN OF BLOOD SUGAR RANGE 56 TO 75 MG. PER 100 C.C. PLASMA

SUGAR	2 HR. AVERAGE LACTATION	2 HR. AVERAGE LACTATION PER SQ. METER	LACTATION GROUP
mg.	c.c.	c.c.	
56	66	45.3	High
62	48	33.3	Average
68	67	39.8	Average
68	31	19.6	Average
72	5.6	3.8	Low
73	50	31.4	Average
73	0	0	Low
75	43	29.0	Low

TABLE VII. BLOOD SUGAR AND CALCIUM VALUES ON THE FIVE HIGHEST LACTATING WOMEN

SUBJECT	AVERAGE 2 HR. LACTATION	AVERAGE 2 HR. LACTATION PER SQ. METER	PLASMA SUGAR PER 100 C.C.	SERUM CALCIUM PER 100 C.C.
	c.c.	c.c.	mg.	mg.
K-k	106.0	63.0	86	9.8
O-l-r	101.6	65.1	88	9.9
Y-l	111.6	71.5	99	10.0
G-b-n	117.3	75.6	99	9.6
H-r-f	146.6	103.9	99	10.05

two hours per 1 sq. meter of surface was 103.6 c.c. of milk. Her daily output was 930 c.c. as measured on the tenth day. On a basis of weight, and allowing a figure of 400 kg. as the average weight of a cow, this woman would have put out 8 kg. of milk a day had she belonged to the bovine species. This is a small milk yield for a commercial animal (cp. the figures of Widmark and Carlens in Table II). The difference between the two species may then be found in the quantity of milk secreted, rather than in any fundamental difference in the process of lactation. Such a conclusion, however, possesses a corollary: It becomes extremely unlikely that we shall see in women any pathologic manifestation such as is seen in parturient paresis in cattle, and originating from the same cause. If parturient paresis in cattle is caused by excessive milk production, and the cause of the symptoms of convulsion and coma lies in a hypoglycemia, it becomes extremely unlikely that postpartum eclampsia in women (and this would be the nearest human analogy) owes its existence to a similar origin.

#### INSULIN AND LACTATION

Although our evidence is thus against any direct connection between the level of the circulating blood sugar and the level of lactation in women such as is claimed in cows, yet we felt our position would be more certain if we measured the milk output under experimentally produced fluctuations in the level of the blood sugar. Particularly

in view of the hypoglycemic theory of "milk fever" we have just discussed, we examined the action of insulin on lactation. Apart from the symptomatic observations of Widmark and Carlens, and of Auger on the effect of insulin on the cow, there appear to exist only two observations on the action of insulin on a normal lactating animal. The first of these is by Giushi and Riotta<sup>23</sup> on the goat who found no effect. The second that of Banu and Heresco<sup>24</sup> who attempted to modify the lactose content of human milk by the injection of lactose, and the injection of lactone + insulin. In both cases the results were negative. Our own experiments are seventeen in number. The two hour lactation test was used as a standard, the average output of milk being noted. On the next morning 10, 15, or 20 units of insulin were given one hour before the beginning of the test. By this time the blood

EFFECT OF INSULIN ON LACTATION  
ABSENCE OF HYPOGLYCEMIC SYMPTOMS  
8 INSULIN

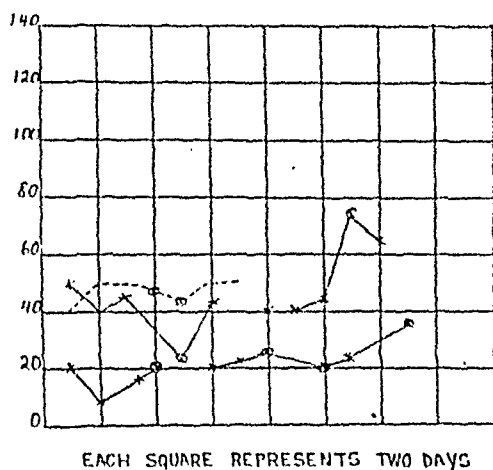


Fig. 3.

sugar level had been lowered, and we were thus able to observe the behavior of the gland when supplied with blood of a lowered sugar content. The blood-sugar level during the test and the occurrence of symptoms were noted. The results are presented graphically in Figs. 3 and 4. Our experiments are divided into two groups according to the presence or absence of symptoms. This is important as the mild symptoms following a low blood sugar (nervousness, tremors, perspiration, weakness) are symptoms of an emotional character, and we have previously discussed the effect on lactation of such simple procedures as the unaccustomed taking of a blood specimen, or the use of a breast pump. The production of emotional symptoms by the use of insulin then could not fail to be followed by a diminished milk flow. The correctness of this argument we think is illustrated in the experiments. Fig. 3 (experiments at-



tended by absence of symptoms) shows only one marked diminution in the two hour lactation test value. In two experiments the milk flow actually increased. In the remaining five the results lie within, or very near, the daily variation of the two hour test value. In this series of seven experiments, the lowest blood-sugar value was 53 mg. per 100 c.c. plasma with an average value of 65 mg. per 100 c.c. plasma. In Fig. 4 (experiments attended by presence of symptoms) are shown nine experiments, and each shows a distinct lowering of milk flow under the influence of the insulin. No increases are to be noted, though some of the decreases fall within the normal fluctuation. Four, however, are decreases outside the range of daily varia-

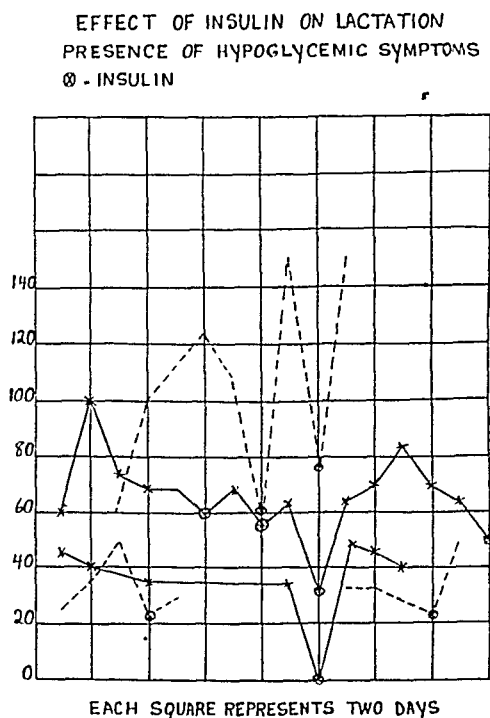


Fig. 4.

tion. One in particular shows a milk output of zero under the influence of insulin. This case showed the most marked reaction of all. The blood sugar fell to 48 mg. per 100 c.c. and a slight degree of cyanosis was noted as well as marked tremors and weakness. The average blood sugar of this group under the influence of insulin is 55 mg. per 100 c.c. plasma, a value lower than that shown in the cases of Fig. 3 but not sufficiently low to cause true hypoglycemic symptoms. Indeed, some of the symptoms were of the slightest, and would ordinarily have passed unnoticed had we not been particularly watchful. Nevertheless, even a slight headache, observed in two experiments corresponded to large downward fluctuations in milk output. The experiments we have just detailed may perhaps possess a bearing on the theory of the hypoglycemic origin of "milk fever" in cattle.

With the onset of even the mildest hypoglycemic symptoms, lactation should diminish. With the diminution in milk production should come a rise in the blood glucose, corresponding to the lessened strain on the carbohydrate balance. The condition should thus be self-limiting, or at least should show a greater percentage of natural recoveries than that of 50 per cent reported before the use of the Schmidt treatment. The answer to our criticism may perhaps lie in the fact that the great majority of cases of "milk fever" occur at the commencement of lactation, when perhaps the organism is not in a condition to adjust its carbohydrate balance with sufficient rapidity. On the other hand it is in primiparous cows that we should expect to see the greatest inability to adjust an unusual balance, as this would be the first time the mechanism is called into play, whereas the incidence of "milk fever" is highest between the fifth and tenth years. Moreover Greig emphasizes the occurrence of the same syndrome at any period of lactation.

#### PARATHYROID DEFICIENCY AND PARTURIENT PARESIS IN CATTLE

The theory of hypoglycemic origin of parturient paresis in cattle has not been received unanimously by veterinarians. Dryerre and Greig<sup>25</sup> have advanced a theory of guanidine intoxication due to parathyroid insufficiency. The analytic estimation of guanidine is a matter of much uncertainty at present, and figures in support of the theory are wanting. Moreover, the parathyroid deficiency as first proposed by Macallum and Voegtlin,<sup>26</sup> and later proved by Collip,<sup>27</sup> is accompanied by a lowered calcium percentage of the serum. Independently of the theory of guanidine intoxication, Little and Wright<sup>28</sup> struck by a similarity of symptoms between parathyroid tetany in animals and "milk fever" in cattle, suggested a lowered blood calcium as the origin of the convulsions of parturient paresis. They have published observations comparing the plasma calcium content of cows "down" with "milk fever" with the same animal on recovery. In every case the calcium is found to be markedly low when the animal is in the acute condition and raised to normal value on recovery. Moreover, it might be reasonable to expect the calcium exchange to be subject to strain at the beginning or during lactation. The negative calcium balance which most milking animals show is well known. Thus the hypocalcemia theory of parturient paresis would appear to have as much evidence in its favor as the hypoglycemia theory, though Little and Wright do not state whether the administration of parathyroid extract will bring about recovery.

Eclampsia in women has also had its etiology ascribed to a drain upon the calcium of the mother brought about by pregnancy.<sup>4</sup> The average blood calcium is perhaps very slightly lowered during the

latter months of pregnancy,<sup>29</sup> though the values remain within physiologic variation. Observations on the blood calcium during eclamptic seizures show normal values.<sup>30</sup>

#### BLOOD CALCIUM IN LACTATION IN WOMEN

Lactation in general does not affect the level of the blood calcium in animals, although it may unfavorably affect their calcium balance. Figures on the level of blood calcium in puerperium in women are scanty. De Wesselow<sup>29</sup> shows a slightly lowered range of calcium values from the third to the eleventh day postpartum, while Handelman, Rose and Sherwin<sup>31</sup> give slightly higher figures but still within normal variation. No figures are available connecting the serum calcium and milk production in women. We have, therefore, determined the serum calcium in the same series of women in whom we studied the blood sugar and classified our results in the same manner. The calcium was determined in serum by the method of Tisdall and Kramer.<sup>32</sup> The results are shown in Table VIII. The general average serum calcium value of 136 cases on the tenth day postpartum is 9.7 mg. The averages of the low, average, and high lactating women are 9.4, 9.7, and 9.7 mg. serum calcium: figures from which we could not possibly draw the conclusion that the production of a large amount of milk affected the level of the blood calcium. Table VII shows the

TABLE VIII. SHOWING LEVEL OF SERUM CALCIUM AND LACTATION IN WOMEN

LACTATION GROUP	NO. OF CASES	AVERAGE SERUM CALCIUM	RANGE SERUM CALCIUM	GENERAL AVERAGE CALCIUM
		mg. per 100 c.c.	mg. per 100 c.c.	mg. per 100 c.c.
Low	16	9.4	8.0-10.6	9.7
Average	91	9.7	8.0-12.0	
High	19	9.7	8.9-10.8	

serum calcium values of the five highest lactating women. The figures are within the usual normal range, and are a little above the general average. In Table IX are the lactation groups of all the women whose serum calcium ranged from 8.0 to 8.9 mg. per 100 c.c., i.e., slightly below the normal value. The lowest calcium values are found in women of the low lactating group. Indeed, if we considered the results in this table alone, we might draw the conclusion that it is the low lactating women who would be in danger of convulsions rather than the high lactating group, such as would be expected were the analogy between them and the parturient cow to be maintained. Such a conclusion, of course, is impossible in view of the general averages. It again emphasizes the worthlessness of conclusions drawn from a few experiments.

TABLE IX. SHOWING THE LACTATION OF A GROUP OF WOMEN OF SERUM CALCIUM VALUE 8.0 TO 9.0 MG. PER 100 C.C.

CALCIUM	2 HR. AVERAGE 2 HR. AVERAGE LACTATION	2 HR. AVERAGE LACTATION PER SQ. METER	LACTATION GROUP
mg. per 100 c.c.	c.c.	c.c.	
8.0	0.0	0	Low
8.0	5.6	3.8	Low
8.0	7.3	5.0	Low
8.0	15.0	8.4	Low
8.0	50.0	31.4	Average
8.5	18.3	12.5	Average
8.6	18.3	12.7	Average
8.7	30.0	28.0	Average
8.8	55.0	32.5	Average
8.9	51.6	31.4	Average
8.9	15.0	10.1	Average
8.9	88.3	56.2	High
8.9	81.6	55.1	High

## PARATHYROID EXTRACT AND LACTATION

The power of extracts of the parathyroid gland to raise the level of the blood calcium in the dog and in man is now a well accepted fact. Even apart from the possibility of a relationship between hypocalcemia and "milk fever" it would be of interest to observe the effect of a raised serum calcium on the milk output. There appear to be no observations in the literature. We have made observations in two cases. Collip's parathyroid extract (Para-thor-mone, Eli Lilly Co.) was given in the doses shown in Table X to two cases. The effect on the lactation in S-n-n is negative. In G-n it might appear that there was a gradually increasing lactation due to the parathyroid extract. The baby in this case, however, had just been changed from a four hour feeding to a three hour feeding owing to its lack of gain of weight. This would constitute an extra stimulus to milk flow, and in view of this, we feel we cannot argue that the parathyroid extract was responsible. We should like to point out the difficulty we experienced in raising the serum calcium in both these cases. Subject G-n received 40 units a day for three days and 80 units on the succeeding day. Yet the calcium never rose above 11.03 mg. The blood, however, showed a marked anhydremia. The patient felt very nauseated, had a dry mouth, had excessive thirst, and as she herself expressed it, "felt dopy and miserable." These symptoms were alleviated on the next day with the copious administration of fluids. Collip and others have reported acidosis and dehydration in dogs to whom parathyroid has been given in excessive amount. In Collip's report the symptoms followed a hypercalcemia of 14 or 15 mg. Although no such hypercalcemia was observed in our subject we believe that the symptoms were those corresponding to parathyroid excess in dogs, though no acidosis symptoms were noticed. Two days afterwards the subject

developed a temperature with general pains which was diagnosed as a mild influenza attack. No temperature was noted during the anhydremic period. If our conclusions are correct this forms the first record of symptoms occurring after the use of parathyroid extract in the human subject. Subject S-n-n also showed the symptom of headache after 60 units for two days. The anhydremia on the following day was not so marked as in the previous case. The calcium rose to 11.38 mg. It would appear that the administration of parathyroid extract in the lactating human subject is not without its dangers. Although we feel we cannot conclude the presence of a direct connection between parathyroid extract and milk flow yet it must be remarked that symptoms, exceeding in severity many of those experienced by our insulin subjects did not produce a decrease in the two hour lactation test.

TABLE X.—SHOWING THE EFFECT OF PARATHYROID EXTRACT ON LACTATION

SUBJECT DATE	PARATHYROID EXTRACT	SERUM CALCIUM	SERUM PROTEIN	TWO-HOUR LACTATION	NOTES
1925	UNITS	MG. PER 100 C.C.	PER CENT	C.C.	
G - n					
Dec. 15	10	10.4	8.66	40	Baby on three-hour feeding
" 16	40	10.5	8.06	50	
" 17	40	9.8	7.95	55	
" 18	40	10.3	7.96	50	
" 19	80	11.0	8.02	55	Nauseated A.M. Dry mouth, thirsty, miserable
" 20	0	10.8	9.18	60	
" 21	0	10.6	8.00	60	Improved
" 22	0	9.7	7.50	65	Temperature 100°
" 23	0	9.3	7.24	65	Improved
" 24	0	—	—	45	Well
1928					
S-n-n					
Jan. 23	0	9.5	7.85	45	Baby on four-hour feeding
" 24	0	—	—	65	
" 25	0	—	—	60	
" 26	0	10.0	7.20	60	
" 27	0	—	—	70	
" 28	0	—	—	75	
" 29	30	10.2	7.20	70	
" 30	50	11.4	7.30	50	Not feeling well Slight temperature
" 31	0	11.3	8.25	60	
Feb. 1	0	10.1	6.98	45	

We wish to express our indebtedness to Messrs. Eli Lilly Co., for the "Para-thormone" used in these observations.

## FINDINGS IN A CASE OF PUERPERAL SEPTICEMIA

The evidence as we have interpreted it is against any analogy being found between "milk fever" in cattle and a corresponding state in woman if either a hypoglycemia or a hypocalcemia be accepted as a fundamental accompaniment. Either the endocrine balance in woman is more flexible than in the cow, or as we have stated, the amount of lactation in woman never rises to such an excessive amount

as to disturb the balance. It may be objected, however, that all our experiments are on the tenth, eleventh, and twelfth day postpartum, a time when lactation is well established, and any disturbance may be adjusted. We have pointed out that lactation in the dairy cow lowers the blood sugar quite apart from the immediate puerperal period, and that some veterinarians, as stated by Greig, believe that "milk fever" can occur at any period of lactation, though it usually occurs forty-eight to seventy-two hours after labor. In view, however, of this possible criticism, we have made a daily blood examination for sugar and calcium on five subjects for a period of six days, commencing the first morning after labor. These are shown in Table XI. Incidentally the table shows the N.P.N. and amino-acid N values,<sup>33</sup> as these values appear of importance in one case (A-r). These and other values were

TABLE XI. SHOWING DAILY VALUES AFTER LABOR OF N.P.N. AMINO ACID N., CALCIUM AND SUGAR IN BLOOD

DAY AFTER LABOR	1	2	3	4	5	6
<i>N.P.N. mg. per 100 c.c. Plasma</i>						
Y - g	31	—	28	25	25	23
S - r	35	30	29	24	24	24
R - m	25	23	23	20	21	22
R - s	24	22	22	20	23	20
A - r	32	40	50	24	20	22
<i>Amino N. mg per 100 c.c. Plasma</i>						
Y - g	4.8	5.2	4.5	5.0	5.3	5.1
S - r	4.8	5.5	5.3	5.1	5.4	5.8
R - m	5.4	5.6	5.5	5.2	5.5	5.6
R - s	5.0	5.2	5.3	5.5	5.2	4.7
A - r	6.1	6.0	7.8	5.0	5.1	5.5
<i>Calcium mg. per 100 c.c. Serum</i>						
Y - g	9.6	10.0	10.4	9.6	10.0	9.8
S - r	10.4	10.6	10.0	10.2	10.0	10.7
R - m	9.4	10.1	9.4	9.8	9.7	10.1
R - s	10.1	9.6	9.5	8.9	9.9	9.9
A - r	10.0	10.2	8.8	9.1	9.0	9.0
<i>Sugar mg. per 100 c.c. Plasma</i>						
Y - g	92	98	83	98	86	95
S - r	87	87	97	83	88	98
R - m	85	88	88	89	90	92
R - s	76	79	81	83	80	85
A - r	97	92	100	115	102	96

determined in all cases studied but are not included in this paper as they are not pertinent to the particular phase of the subject under discussion. The figures show no remarkable or characteristic variation due to the onset of lactation. Case Y-g belonged to the low-lactating group and R-n to the average-lactating group. The interest of the table lies in subject A-r who on the third day showed a moderately raised N.P.N. of 50 mg., a high amino-acid N of 7.8 mg. and a sudden drop in the calcium to 8.8 mg. Whether the rise in sugar to 100 mg. is part of the same disturbance we do not know. The rise in N.P.N. and amino-

acid N are outside the normal fluctuation. Of nearly 130 cases, studied on the tenth day postpartum, only 3 show amino-acid N values of 6.0 mg. or over. The disturbance is evanescent. On the next day all that is left is a slightly raised blood sugar, but even so, this figure would be accepted as within the normal range. The disturbance was probably due to the onset of a mild puerperal infection as it was accompanied by a temperature, and a culture of streptococcus hemolyticus was obtained from the cervix. The temperature was normal the next morning, though occasional rises were noticed later. The occurrence of a sudden drop in calcium in this case on the third day postpartum presents the only analogy we have been able to find between "milk fever" in cattle and pathologic postpartum disturbance in woman, a disturbance much more likely due to infection rather than to lactation. In view of the markedly pathologic value of amino-acid N we have found, it would be interesting to know the value found in parturient paresis in cattle, especially as the effect of lactation in the cow is to produce a low value. In man it is extremely difficult to find examples of disturbance in this substance in the blood.<sup>34</sup>

#### GENERAL CONCLUSIONS

If parturient paresis in cattle is fundamentally attended by either of the biochemic phenomena discussed in this paper, it appears very unlikely that its analogue will be discovered in woman. Such a conclusion is based upon the hypothesis that excessive milk production is an essential condition of parturient paresis, a hypothesis accepted by all veterinarians as far as we are aware. That even high lactating women do not attain that plentitude of production reached by dairy animals may perhaps represent the difference between the two species, as we have suggested. Nevertheless it seems strange that no trace of the disturbance can be found in women, so strange that it may engender doubts as to the fundamental nature of either the hypoglycemic or hypocalcemic theory of the pathologic manifestations in cattle.

#### SUMMARY

1. The recent theories of parturient paresis in cattle are discussed in the light of a possible relationship to similar disturbances in women.
2. A lactation test of two hours' duration has been devised for women, and its relationship to the twenty-four-hour output of milk has been studied.
3. Seventy-one per cent of the women examined secrete 10 to 40 c.c. milk per square meter of surface per two hours. This constitutes the average lactation group.
4. Only 15 per cent of women secrete over 40 c.c. milk per square meter of surface per two hours, constituting a high lactation group.

5. There is no essential difference in the blood-sugar level of the three lactation groups, the average figure being 95 mg. per 100 c.c.
6. Hypoglycemias produced by insulin lower the milk output, if the hypoglycemia is accompanied by nervous or emotional symptoms.
7. The average serum calcium level for 136 cases is 9.7 mg. per 100 c.c.
8. There is no essential difference in the level of serum calcium between the three lactation groups.
9. The administration of parathyroid extract has no influence on the milk production.
10. It appears difficult to raise the serum calcium by parathyroid extract during lactation.
11. Toxic symptoms have been noted by the administration of parathyroid extract to a human subject.
12. Some abnormal chemical findings are reported in a case of puerperal septicemia.

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## REPEATED LAPAROTRACHELOTOMY, 91 CASES\*

(LOW, OR CERVICAL CESAREAN SECTION)

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**A**MONG the seventeen superior advantages possessed by the low, or cervical operation, two are always mentioned as being of such importance that they alone should induce all thinking accoucheurs to adopt the cervical approach to the uterus for all cases requiring abdominal delivery.

The displacement of the classic operation by laparotrachelotomy is proceeding so rapidly all over the world, and the operation has been adopted as standard by so many obstetric authorities, that one must conclude its primary mortality and morbidity are now proved to be better than all other methods of cesarean section.

It remains, therefore, to discover the facts regarding the late mortality and morbidity, that is, how women who have had one cervical cesarean get along afterward, whether the fear of abdominal delivery restricts future childbearing, or whether the incised uterus becomes sterile, also how the uterus acts in subsequent pregnancies and labors, and what are the findings at subsequent operations.

We have tried to follow up the cases on whom the laparotrachelotomy has been done, but the moving qualities of our population have prevented us from learning much of value. One may surmise, from the fact that few of the women have returned to us for gynecologic treatment and still fewer have responded to the questionnaire we sent out to them, that the low section does not compromise their health.

The exact effect of the operation on fertility could not be determined, but since we are able to present 91 cases of repeated section it shows that this element does not act very strongly inhibitive.

The two advantages of the low cesarean above referred to are the integrity of the uterine scar and the absence of abdominal adhesions. The health of the women, fertility, their safety in pregnancy and labor, all depend on these two factors and from a study of our 91 cases we may deduce practically valuable facts.

The statistical material used in this paper was collected, tabulated, and abstracted by my associate Dr. Luella E. Nadelhoffer, and the microscopic study of sections of the cervix, removed at operations, was done by my associate Dr. J. P. Greenhill, to both of whom should go the credit for the much greater work done. All I did was to as-

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semble the information brought to me by them and make a few general comments. Only a small portion of their findings are presented here.

Of these 91 cesareans I performed 31, my 8 associates the other 60.

In 718 cases of laparotrachelotomy, 82 were done for the second time, 8 for the third, and one for the fourth time.

TABLE I

INDICATIONS FOR FIRST SECTION	NO.	PER CENT
Contracted Pelvis	69	83.1
Toxemia	6	7.2
Abruptio Placentae	2	2.4
Placenta Previa	1	1.2
Fibroid Uterus	1	1.2
Amputation of cervix	1	1.2
Cardiac defect	2	2.4
Threatened rupture of uterus	1	1.2
	83	

The indications for the first laparotrachelotomy were mainly contracted pelvis, 83.1 per cent (Table I) and naturally the indication was carried over into the second pregnancy. The fact of there having been one incision in the uterus already would strengthen the indication for a second section although I believe, and most men doing the low operation insist, that this element of danger requires much less consideration than does the scar after the classic section.

TABLE II

INDICATION FOR FIRST CESAREAN SECTION	INDICATION FOR SECOND CESAREAN SECTION
Toxemia (6 cases)	1. Toxemia again 2. Toxemia again 3. Cephalo-pelvic disproportion 4. Threatened rupture of uterus—in labor eight hours 5. Elective 6. Threatened rupture of uterus
Abruptio Placentae (2 cases)	1. Forty-eight hour test of labor 2. Elective
Placenta previa (1 case)	Elective
Fibroid Uterus (1 case)	Same indication
Amputation of cervix (1 case)	Same
Cardiac defect (2 cases)	Same
Threatened rupture of uterus (1 case)	Elective

All the patients who had third cesarean sections had contracted pelvis, also the patient on whom the fourth section was done.

Table II shows the indications for the second section when the first was not done for contracted pelvis. Toxemia recurred twice, and in two cases a rupture of the uterus was feared.

TABLE III. TIME INTERVAL BETWEEN FIRST AND SECOND CESAREAN SECTION

	NO.	PER CENT
1 to 1½ years	13	15.7
1½ to 2 years	11	13.3
2 to 2½ years	17	20.4
2½ to 3 years	11	13.3
3 to 3½ years	10	12.0
3½ to 4 years	9	10.8
4 to 4½ years	4	4.8
4½ to 5 years	5	6.0
5 to 5½ years	1	1.2
5½ to 6 years	1	1.2
7 to 7½ years	1	1.2
	—	
	83	

TABLE IV. TIME INTERVAL BETWEEN FIRST AND SECOND AND BETWEEN SECOND AND THIRD CESAREAN SECTION

	FIRST AND SECOND	SECOND AND THIRD
11 months		1
1 to 1½ years	2	4
1½ to 2 years	1	1
2 to 2½ years	2	
2½ to 3 years	1	
3 to 3½ years	1	1
4 to 4½ years	1	
4½ to 5 years		1
	—	—
	8	8

TABLE V. FOURTH CESAREAN SECTION, TIME INTERVAL BETWEEN

First and second	1½ years
Second and third	1½ years
Third and fourth	3½ years

Tables III, IV, and V, show that the interval between the several sections varied from one to seven and one-half years, 40 women having a second child within two and one-half years. This is a large percentage (51.3 per cent) and is slightly greater than the percentage of second births of 100 women taken at random from the hospital files (50 per cent). It is generally admitted that a relative sterility remains after the classic cesarean. In eight of the third cesareans 6 of the women had conceived within one year after the second operation. As far as sterility is concerned we cannot say that laparotomectomy restricts it very much, and this is a strong argument for the cervical operation.

The youngest patient on whom the section was repeated was twenty-one, the oldest forty. In all patients the pregnancies were at or about term. Since the second cesarean was nearly always foreseen, a large percentage were elective, i.e., nearly 60 per cent, but the rest were given a test of labor lasting from one to forty-six hours, the majority

having less than twelve hours of pains. In these patients it was possible to see the effect of labor on the lower uterine segment and scar.

Local anesthesia was the anesthetic of choice and was successful in 60 per cent of the cases, ether being next with 33 per cent; combinations being used in the remainder. Of late years we are learning how to treat the minds of our patients better, and the local method is now being found practicable in more than 90 per cent of operations, and even for Porro.

Sterilization was performed after the second section whenever the patient and her husband desired it, and we have finally, after much experimenting, adopted the simple method of Madlener. Thirty-one of the 91 patients were sterilized.

In the 718 laparotrachelotomies there were 9 maternal deaths, 1.2 per cent. One woman died after her second operation. One died after her third, a total mortality of 2.2 per cent in the 91 repeated sections. Of the babies 4 died, one a monstrosity (anencephalus), one from atelectasis (the child of the mother who died after the third section) and one from sepsis, probably umbilical, one from infection acquired before labor.

The first mother who died weighed over 280 pounds, entered the hospital in labor with a foul discharge, the bag of waters having ruptured two days before. The child when delivered had a purulent discharge from the nose and a temperature of 102°. It died of sepsis the fourth day. The uterus was foul at the operation. Death was due to peritonitis which probably came from the uterus, although some of the symptoms pointed to the gall bladder. The second death was most peculiar and presents many interesting aspects. During her first pregnancy this patient suffered from anemia whose nature was not determined by the internist. She was of the hypoplastic type, enteroptotic, flabby, with weak mesoblastic tissues. Her abdominal walls were so thin that the uterus could be seen through it. Her first labor dragged on for several days. Laparotrachelotomy was performed. On the thirteenth day fever of 103° appeared and, since there were no lochia, we diagnosed retention and passed a soft catheter into the uterus, nothing came out, but the patient very soon afterward developed double phlegmasia alba dolens. Recovery after two months.

During her second pregnancy the anemia reappeared and a new symptom, uterine contractions simulating labor pains, and requiring narcotics. These kept up from the end of the sixth month into the eighth giving some concern as to the integrity of the lower uterine segment scar, and also for the baby's life. When the child was appraised at 5½ to 6 pounds a second laparotrachelotomy was performed. The baby weighed 5¾ pounds and died in six hours of atelectasis pulmonum. The mother became enormously distended,

without fever, had stercoraceous vomiting for twenty-four hours, but recovered. I warned her not to get pregnant again, but she did and had a spontaneous abortion at three months. Not long thereafter she reappeared, now at the seventh month of gestation with only mild uterine contractions. At term the bag of water ruptured and a few pains occurred. Since the pelvis was slightly justo minor, the head high, occiput posterior, the cervix closed, a third laparotrachelotomy was performed. The scar was very thin but firm. A large, fine boy was delivered. There was a great deal of venous oozing from the wounds, and especially did we have trouble stopping the hemorrhage from the right tubal corner when we resected the tubes to procure sterilization. Her recovery began like the second one, distension, vomiting, not fecal this time, but more obstinate. She had little temperature, pulse of 90 to 110 and slow respiration, her white blood count was 7000 to 5000. A consultation of surgeons could not diagnose peritonitis but when we reopened the abdomen this was found, and it seemed to take its origin from the right tubal corner. I have noticed that our cesareans that have any manipulations on the tubes have more reactions than the others, and believe we probably stir up an infection slumbering in this neighborhood. The other patient who died was also sterilized.

The recovery of the other 89 women was just as smooth as usual, if not better. Primary union took place in all but 4 cases, and pelvic cellulitis was noted twice; 55 per cent had normal temperature.

Intestinal complications, gas pains, distension were noted as severe in 4 cases, mild and temporary in 44 cases; vomiting occurred only in 13 cases and was not marked. One patient on the day she arrived at home had a severe pulmonary embolism but happily recovered. In her case the transverse incision was made and bleeding at the outer angles of the wound required numerous sutures.

The behavior of the cervix in subsequent pregnancy and labor presents little of importance in this discussion.

Of 48 women who could be followed up, menstrual disturbances not existing before were found in 10; one woman had profuse menses; 44 had regular periods, 3 irregular, 1 none at all. Forty-four patients nevertheless said they felt "very well." While the dysmenorrhea was not pronounced, its occurrence is interesting.

One patient complained of bladder disturbances, 2 of backache.

That fertility is little interfered with is shown by the fact that we were able to do 91 repeated sections in a total of 718 cases. Pregnancy after the first section did not present anything unusual. Four abortions were reported in women who had had one laparotrachelotomy which is not a remarkable incidence. Out of 136 classic sections done during the same period, 4 women had abortions, proportionately 5 times as many.

Premature labor was not noted, indeed several of the women went over term. There was no case of rupture of the uterus either during pregnancy or labor. Even the patient with the thin scar above referred to did not give any concern.

✓ At least twelve women, after previous laparotrachelotomy, have been delivered from below, some spontaneously and others by forceps. In one case labor was induced by bag. Labor lasted from two to thirty-five hours and in many cases the pains were very strong. The babies weighed from 2500 to 4255 grams. One patient had two vaginal deliveries after laparotrachelotomy and another patient had two vaginal deliveries after two laparotrachelotomies. All this speaks well for the integrity of the cervical scar, although anatomically, as Dr. Greenhill shows, much is to be desired in the restoration of tissue.

Of special interest are the findings at the second laparotrachelotomy. No unusual difficulties were encountered in opening the abdomen. One hernia was met. Adhesions were found in 40 per cent of the cases but they were mostly very thin and easily treated. They were between the uterus and omentum, abdominal wall or omentum, or between peritoneum and uterus. Of the 8 third cesareans 5 had adhesions but the woman who had a fourth laparotrachelotomy had no adhesions at all. In 2 cases expansive gauzy adhesions made it possible to do the second trachelotomy extraperitoneally. I have met with adhesions after the classic section, where they occur in 85 per cent of cases and are dense, often intestinal as well as utero-abdominal. There is no comparison between the two cases. All the advantages are with the low operation, as far as adhesions are concerned.

The bladder is separated from the lower uterine segment with a little more difficulty in the second sections. The histories are incomplete on this point. My memory says that the frequency of firm bladder adherence to the uterus is not great nor the complications at all hard to overcome. The location of the bladder requires some consideration. Since the majority of repeated sections are elective, and labor pains have not unfolded the lower uterine segment the bladder is usually low in the pelvis, unless it was elevated by the first operation. When we were overlapping the peritoneum in the two flap operation, it was not uncommon to find the bladder fixed high on the uterus and also drawn up out of the pelvis permanently, being elevated also on the anterior abdominal wall. In 78 cases the bladder is recorded as high in 39, low in 36 and normal in 3. These figures are about what we find at first sections and, therefore, mean little.

The records are incomplete as to the quality of the uterine scar. Of 29 cases it was mentioned as thick in 18, thin but strong in 3, thin in 3, not seen but felt in 4, and separated in one (previously mentioned).

Dr. J. P. Greenhill studied 40 pieces of the lower uterine segment

removed at the time of the second laparotrachelotomy and presents herewith a preliminary report on 31 specimens. In 5 of the 40 he reports thin scars.

*Histology of Uterine Scars.*—(J. P. Greenhill, M.D.) In 31 instances at the time of the repeated cesarean section, pieces of tissue were removed from the site of the previous incision in the lower uterine segment. In addition, pieces of tissue were removed from three uteri at the time of a first operation for purposes of comparison.

In 26 of the 31 specimens studied there were distinct evidences of scarring. The remaining five blocks failed to show any scar tissue whatever. This means that in these five cases the incision healed perfectly or that the pieces of tissue were not removed from the site of the former operation or operations. For at the time of a repeated low cervical cesarean section it is unusual to recognize the site of the previous incision with the naked eye before incising the lower uterine segment. The remaining 26 specimens in which scarring was present can be roughly divided into three groups, depending on the degree of scarring. In three cases, the changes were striking, consisting essentially of marked thinning of the uterine wall and replacement of a great deal of muscle tissue with fibrous tissue. In each of these specimens the wall of the uterus contained a sharply localized area of constriction, so that the wall measured less than a third of a low powered microscope field in thickness. In two of these, this portion of the wall was made up of approximately equal parts of muscle and fibrous tissue, but in one the muscle tissue had been almost completely replaced by collagen and a small amount of elastic tissue. Large amounts of fibrous tissue extended outward into the normal myometrium. Into these scars the endometrium and parametrial tissue were sharply drawn. In none of these sections was there any evidence of disintegration of the wall of the uterus, as was suggested in some of the scars described below.

In the second group were placed those cases where undoubted scars of the old incisions were present, but in which the integrity of the wall remained essentially unchanged, even though several showed slight thinning of the wall. Most of these scars were composed of dense masses of fibrous tissue frequently arranged cicatrically. Others contained various amounts of muscle tissue bundles and individual cells, many of which were surrounded by collagen. In a few instances the scarring was extensive, reaching from the endometrium to the parametrium and involving large areas. In many specimens large interstitial areas of diffuse, irregular scarring were present. Most of these scars were represented by fibrous tissue replacement but there were a few in which the tissue, although arranged irregularly with a tendency toward cicatrization, was mostly muscular. A number of the fibrous scars contained dense masses of elastic fibrils, others were

found with diffusely scattered elastic tissue and some were almost entirely free of elastic tissue. No factors governing the formation of elastic tissue were determined, but there did not seem to be any relationship to the amount of collagen. Several dense scars had large amounts of coarse elastic fibers; other equally dense scars were relatively free from it. It is possibly of some significance that, in general, those scars which consisted of dense masses of fibrous tissue showed, within the scar proper as well as in the adjacent myometrium, marked edema of the fibers so that in places isolated muscle cells were imbedded on a pale-staining, very loose, edematous, fibrous tissue network, giving the impression of early "tearing" of the tissue. This group included 15 cases, one of which could conceivably fall into the first group.

The remaining cases, eight in number, showed minor degrees of scarring of the same general type. The one with the least evidence of scarring contained only two small puckered areas, one of muscle and the other of collagen, both areas being interstitial. The lesions of this group were of microscopic size, and are thought to be of purely anatomic rather than physiologic significance.

While looking for scars in these tissues, we found two cases with distinct acute inflammatory reactions, diffusely involving the endometrium and subjacent myometrium. These reactions consisted of edema and especially in one case, of marked leucocytic infiltration. No relationship to blood vessels was noted, the process being a diffuse one involving the inner surface of the uterus. No bacteria were seen in the sections. One of the patients from whom a piece of tissue was removed had no labor pains when the cesarean section was performed and the other had been in labor two hours. In both cases the bag of waters was intact at the time of operation.

These sections were stained with hematoxylin and eosin, and by the Weigert-van Giesen method, in which nuclei stain blue, muscle tissue greenish-yellow, collagen red, and elastic fibers black. This study is being continued.

The scars were found thin in many cases yet they held throughout pregnancy and more or less hard labor. In only the one case the peritoneum seemed to lie on the decidua, and in all probability this lower uterine segment would have ruptured had much of a strain been put on it.

Dr. Greenhill is making a further study of the microscopic slides and the clinical records with a view of determining whether the method of suturing, continuous or interrupted, has anything to do with the resultant scar. Thus far it seems to be proved that thin scars oftener follow continuous suturing. I have been practicing and teaching the interrupted suture of the lower uterine segment for the last four years, basing my opinion on my own findings at operation. Now a pathologic foundation is placed under it. The interrupted



suture takes longer, and the patient loses more blood while it is being put in. Where haste is needful because of hemorrhage, one may compromise and put in one row or part of one, continuous and finish the closure with interrupted.

It seems that perfect anatomic restoration of the cervix is not necessary for the strain of subsequent labor. All that is needed is a good scar. In the world's literature there are only 12 cases on record in which rupture of the cervical scar took place. All these women were in strong active labor and only two of the mothers died. Compare these figures with those of the classic section, with its high percentage of ruptures during pregnancy, when the patient is usually at home without any warning, such as labor pains give; also note the still higher percentage of rupture during labor, and a large mortality in both.

I have always put forward that the laparotrachelotomy is not as simple an operation as the old classic, that it usually presents only such difficulties that an ordinarily skilled abdominal operator can master with ease. We must not forget that occasionally a classic section will also have complications, especially if it is a repeated one, that will tax the surgeon's skill, and the same is true of the repeated low cesarean. In all cases of primary and second laparotrachelotomy, the technic is easier if the patient has been in labor a moderate length of time because then the lower uterine segment is long drawn out and thin, and the bladder separated from it. These advantages are absent with repeated section which is almost always an elective operation. Occasionally if labor has not supervened and the lower uterine segment has not unfolded well one has to extend the incision one to three centimeters upward into the corpus uteri. The two instances in our tables where the cut was made longer (up to 2 inches), were *lapsi artis*. No harm results from this as the whole incision can be well peritonealized, and if a second or third elective section is to be done, there is no danger from rupture of the scar as with the low incision this only occurs after prolonged and powerful labor.

In all second laparotomies care is necessary in opening the abdomen, as an occult hernia may exist. Adhesions are seldom met, as was said, but one must be prepared for an elevated bladder. The peritoneal opening, therefore, must be made at the upper end of the incision. The anterior culdesac, especially if the overlapping of the 2 peritoneal flaps was extensive may be very high and distorted. Adhesions, if the previous section was a classic may twist the uterus, if a low operation, this is rare. Where the healing of the first section was afebrile, one need not fear that the separation of the bladder from the lower uterine segment will be difficult. If suppuration occurred, one must proceed carefully with the dissection. We have not injured the bladder in any repeated operations nor have we tied or

cut the ureter. Uretero-pyelitis is noted as a complication in the recoveries from laparotrachelotomy in about 3 per cent. This is due to two causes, first we perform this operation frequently in threatened eclampsia, and toxemia is often the result of this inflammatory underlying disease; second, when the bladder and the ureters are lifted off the lower uterine segment, the disturbance may light up a slumbering infection. There was only one case of cystitis in this series of repeated sections.

Really there is little to say about the technic of a repeated laparotrachelotomy. It is usually just like the first one and when it is not, general surgical principles apply.

Should one sterilize the woman after her second abdominal delivery? Yes, if she and her husband demand it, although I usually dissuade them from such a course. I do not try to dissuade them after a third section. If the patient is well on in years, a Porro is probably the best way to sterilize. In young women Madlener's method, simple and efficient, can be done. A loop of the tube is held up, crushed carefully with a heavy forceps and a silk ligature laid in the groove.

In closing the abdomen the interrupted suture is used throughout because scar tissue does not unite as well as healthy, and a continuous suture compromises the circulation too much.

Altogether, a second laparotrachelotomy is not quite as easy as the first, but this is true of all second laparotomies.

5028 ELLIS AVENUE.

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## SALPINGITIS: THE CASE FOR EXPECTANT TREATMENT

BY C. JEFF MILLER, M.D., NEW ORLEANS, LA.

AS HOWARD KELLY once remarked, surgery developing in the hands of men has dealt too lightly with mutilating operations in women, and if the case might be reversed for several decades, with women operating and men suffering the mutilation, there would undoubtedly be a large prepossession in favor of wise conservatism. His point is well taken. Since the ablation of the female sexual apparatus is not ordinarily a procedure which endangers life, there is a tendency, unfortunately a somewhat general tendency, to remove it, in whole or in part, on indications which, in another part of the body, would be considered rather trivial. Function is lost sight of, sentiment is thrown to the winds, and unnecessary and mutilating surgery is done without a consideration of equally satisfactory and more conservative modes of treatment, without a recollection of the fact that a woman's whole scheme of life takes its point of departure from her pelvic

organs. If that one point alone were borne in mind, a new day would dawn in the management of many types of pelvic pathology.

Almost twenty years ago F. F. Simpson read before the American Gynecological Society a paper which revolutionized the treatment of tubal disease. Prior to that time its management had been purely surgical. Operation was done routinely, as soon as the diagnosis was made, and because it was done in the acute stage, ablation of the entire genital tract was often a necessary consequence. The result was not only a group of thoroughly unsexed women, at least in the physiologic sense, but also a death rate approaching 20 per cent. Then came Simpson with his advocacy of the delayed operation, with the plea that surgery should never be resorted to in acute salpingitis until the temperature had been consistently normal for at least three weeks, even after repeated bimanual examination, until there had been absolute recovery from the acute attack, and until there had been a complete absorption of the inflammatory exudate surrounding the primary focus of infection. These astounding proposals could not be ignored, revolutionary as they were, because their advocate was able to show for them in a series of more than four hundred cases the hitherto unheard of mortality of 1 per cent.

Almost from that day the accepted treatment of acute salpingitis has been medical and not surgical, but in spite of the proved results of the delayed operation, there are still those who advocate a return to the old plan of immediate surgery. The fact that the majority of these men are brilliant and expert surgeons makes their arguments particularly dangerous. Their individual results, I grant you, are striking, but we must not lose sight of the fact that the bulk of all surgery is done not by surgeons of this eminence but by men of average ability, or, to speak bluntly, of small ability, whose disregard of established principles may have a very different outcome.

Salpingitis, you will recall, is essentially a bacterial invasion of the fallopian tubes in which practically any organism, either singly or in combination, may be the responsible factor. While it is generally conceded that at least 70 or 75 per cent of all cases are of gonorrheal origin, laboratory confirmation is possible only in a relatively small percentage of these. The gonococcus is an organism which cannot exist without oxygen, and once it has become encapsulated in the tube, death is inevitable and activity ceases. Clinically this process is accompanied by a fall in the temperature, the gradual absorption of the inflammatory exudate, and finally the complete recovery of the patient from the acute attack. The correspondence between the recession of the bacterial activity and the clinical improvement is indisputable, and Curtis makes the unqualified statement that in all his experience he has never isolated the gonococcus from the secretions of patients

who either failed to reveal gross evidence of active inflammation or who had been free from fever for a minimum of ten days. It is his opinion, therefore, that persistently active tubal disease is not, as it has long been regarded, a chronic condition with acute self-originating exacerbations, but rather either a fresh infection from without or a fresh extension upward from a chronically infected lower genital tract.

With the nonspecific organisms the situation is somewhat different. The acute attack tends to subside, the exudate tends to be absorbed, exactly as when the specific organism is present, but the nonspecific organisms are anaerobic, and they therefore, although quiescent, have in them decided potentialities for harm for unknown periods of time. Their longevity has never been definitely limited and the streptococcus, at least, has been isolated from the tube as late as nineteen years after the original attack.

From these facts and from studies of the clinical findings in literally thousands of cases of tubal disease, certain indisputable conclusions emerge. Salpingitis, at least of the specific type, tends to recede spontaneously from the acute stage; that is, autosterilization tends to occur and the woman develops her own immunity and can protect herself against the bacterial invasion which has taken place. In the non-specific type spontaneous regression is likewise the rule, though the organisms retain their activity for unknown periods of time. In the second place, spontaneous clinical recovery must be considered at least a possibility in every case of salpingitis, though naturally it is more frequent in the mild than in the extremely severe type. In the third place, involvement of the general peritoneal cavity is exceptional and death during an acute attack is equally unlikely.

These are proved clinical facts, the acceptance of which carries the corollary that the factor of safety cannot enter into the plea for immediate operation. The patient, other things being equal, will not die because operation is withheld, and the case for prompt surgery must, therefore, be argued on some other premise. Certain arguments may be promptly demolished. Thus salpingitis is not comparable to such a condition as appendicitis, where delay would be fatal. The diagnosis is usually so clearcut that it can seldom be confused with other abdominal pathology in which prompt surgery is essential. Rupture of a pus tube is an unlikely contingency; in fact, the few cases in which this catastrophe has occurred are reported in the literature almost as surgical curiosities.

Moreover, the other side of the picture must not be forgotten. It must be borne in mind that immediate operation is done in the face of active bacteria, in the face of fresh adhesions, in the face of structures so vascular, so infiltrated and so friable that they may be injured by even the gentlest manipulations, while the delayed opera-

tion is done when the bacteria are dead, when the pus collections are sterile, and when extensive contamination of the field of operation with resulting peritonitis is not so likely to occur. Another consideration not to be ignored is whether a patient already acutely ill from a bacterial disease is in a condition to stand the added strain of surgery since, and this is the crucial point, her life, as we have already shown, does not hang upon its prompt performance. Moreover, it must never be forgotten that surgery, when it is done, is done for the *results* of the acute attack, not for the attack itself, which may subside spontaneously and which may leave no secondary pathology, so that routine operation for a condition which at least in a certain percentage of cases, will be cared for by nature rather than by art, can be classified only as unnecessary surgery.

It has not yet been proved, either, that immediate operation is as safe an affair as its advocates would have us believe. In the hands of the surgeon of exceptional ability the claim is certainly justified. Victor Bonney lost one patient in twenty years, DuBose's mortality is one in four-hundred-nineteen cases, but in general practice the results are very different. I recently had occasion to study six hundred cases of salpingitis, treated surgically, from the records of Charity Hospital and of Touro Infirmary, which comprised the work of fifty-seven different surgeons. The series included both cooled and uncooled cases, and the gross death rate was 3 per cent, or three times as high as the accepted risk for surgery of the tubes. The rate for the cooled cases was less than 1 per cent, while the rate for the uncooled cases was 4.2 per cent. Or, to express it differently, approximately 90 per cent of the mortality occurred in patients who had not been properly cooled. It is something more than coincidence, too, that three-quarters of the postoperative morbidity developed in patients who had not been allowed to recover completely from their original infection. The death rate, you will note, is not the only point to be considered.

These figures from a composite series are to my mind far more representative than are the brilliant individual showings of such men as DuBose and Bonney. They prove again that the mortality of the average surgeon or the average mortality of all surgeons is a far better index to the wisdom or unwisdom of a given course than are the records of individual experts. It cannot be too often emphasized that while the experienced and dexterous surgeon may violate with impunity all surgical principles, such temerity on the part of the average man can lead only to disaster. On the surface it does seem paradoxical to permit a debilitating disease to run its course as a means of fitting a patient to withstand a major surgical procedure, but the facts prove the case.

Looking at it from another aspect, let me point out that immediate operation seldom permits conservatism. Since the involvement of the pelvic organs is general, since localization has not yet occurred, since nature's protective mechanism has not yet been set in order, total extirpation of the pelvic organs is frequently necessary. To quote DuBose's own words, "Pelvic debridement should include at least the removal of the pyogenic membranes with the infected tubes, uterus and ovaries." There is no semblance of conservatism in any such wholesale resection as that. If a competent surgeon is in charge the woman will probably emerge with her life, but she may also emerge with her sexual existence irrevocably ruined. And the tragedy of that lies in the fact that salpingitis is essentially a disease of young women, that the great majority of all cases occur in the prime of functional life. The argument that the tubes thus removed are functionless is unwarranted; Holtz's report, for instance, in which 12 per cent of pregnancies is shown to have followed purely expectant treatment utterly disproves that claim.

Finally, the various types of conservative operation which are supposed to be possible when immediate surgery is done have by no means justified the plan. Splitting and drainage of the tube is advocated with enthusiasm by one surgeon, another pleads for plastic operations such as are done during the chronic stage, a third advocates partial salpingectomy. Aside from the fact that the latter operation is particularly to be condemned because it may pave the way for a future ectopic pregnancy, not a single one of these procedures, as we shall point out later, can show the results which follow carefully ordered conservative methods. As one shrewd observer puts it, if pregnancy does not follow the old method of delayed operation, it is yet to be proved that it follows the revived method of immediate operation. And even granting the argument that a woman who has been treated expectantly and whose tubes are sealed obviously cannot bear children, even granting that argument, I would point out that that woman is no more absolutely sterile than is she whose tubes have been removed at laparotomy for acute salpingitis.

To my mind the only argument in favor of early operation which has the slightest weight is the argument of expediency. Often in private practice, more often on public hospital services, we are called upon to treat patients who cannot rest indefinitely, who cannot, for social or economic reasons, run the risk of a recurrence of their original condition. But even here there is no excuse for surgery until all the dicta of the delayed operation have been observed, absolute subsidence of the acute attack, resolution of the exudate, and a consistently normal temperature for at least two weeks in spite of repeated bimanual examinations, which, by the way, offer a better index of the patient's condition than any amount of laboratory work. It need

scarcely be pointed out that a woman who cannot stand the slight trauma of a bimanual examination without a febrile reaction is clearly unfitted to withstand the greater trauma of a laparotomy with its inevitable intraabdominal insults.

But when, you will ask, should operation be done? When is it finally justified? How long should one delay? I admit that once the patient has recovered from her acute attack the temptation is strong to operate in the interval, but even then the wise surgeon is the one who continues to wait. For one thing, only time can tell whether the first attack will not also be the last. This is frequently the case when the infection is of gonorrheal origin, and in nonspecific infections, as we have already pointed out, the longevity of the bacteria is an unknown quantity, so that the patient's safety is really best assured by an indefinite delay. A safe rule in all instances is to wait until the infection is thoroughly cooled and then to continue to wait. Even if the patient is not cured by this method, at least nothing is lost, for if the attacks continue to recur, if the symptoms continue unabated, if the patient's general health seems likely to be affected, operation can be done quite as safely later.

Moreover, the patient herself should have some voice in the matter, for she is the best judge of her own condition. If my patients consider themselves well, if they are able to resume their normal habit of life and to do their daily work with only brief periods of disability, I am quite willing to agree with them that they are well, even though the pelvic findings may not be entirely to my liking. It is possible, too, given the choice, that the patient may prefer to retain her organs, damaged though they be, on the chance of an ultimate clinical and functional cure. As Chipman well puts it, "Half a loaf, and a painful loaf at that, is better than no bread." A woman's sexual organs are the basis on which her whole life is founded, and her sexual sanctity, to express it as strongly as I can, should be violated only in the face of an urgent need, which a single attack of salpingitis rarely constitutes.

The wisdom of this plan has been repeatedly proved. In more than a thousand cases of salpingitis treated by purely expectant methods Holtz secured 82 per cent of clinical and 12 per cent of functional cures, and had only 2 per cent of absolute failures. Since 1921 in the clinic of Arthur Curtis of Chicago the plan has been to refrain entirely from operation for gonorrheal salpingitis on the principle I have already outlined, that recurrent attacks are fresh infections rather than fresh outbreaks of an original infection. The patients are isolated from their infected consorts, even douches are prohibited, and the treatment is entirely expectant. Not only have the clinical cures been brilliant, but the number of functional cures has been surprisingly large, and it may well be that another generation in medi-

cine will see surgery in such cases entirely eliminated and expectant treatment the routine plan.

It might be well to outline briefly the method by which these cases are handled. The cardinal principle is rest in bed, absolute rest, not for a few days but for many days, indeed for many weeks, until the temperature has been persistently normal for a minimum of two weeks in spite of repeated vaginal examinations. During the acute attack, pain is relieved by ice caps and local applications as indicated, with opiates used sparingly when necessary. The bowels are regulated by mild cathartics and gently given enemas; drastic cathartics have no place in the management of a pathology which can be excited to fresh outbursts merely by intestinal peristalsis. Fluids are forced by proctoclysis, by hypodermoclysis, even by infusion, and transfusion is resorted to in extremely debilitated and toxic patients. Douches are not routine but if they add to the patient's comfort and are cautiously given I do not believe them harmful. Surgery is limited to the opening of localized pus collections pointing in the culdesac or above Poupert's ligament. There is nothing subtle, nothing complicated about this treatment, and I sometimes wonder if its extreme simplicity, its total lack of action, is not the reason why more gynecologists are not willing to follow it absolutely.

When surgery is inevitable, its extent should be based not only upon the pathology present but upon the age and social condition of the patient and, to a certain extent, upon her own desires; if a woman is so situated that she can take the admittedly dubious chance of a functional cure which conservative surgery offers in specific infection, she has certainly the right to take that chance, provided she takes it with a full knowledge of the facts.

Speaking categorically, when the process is tuberculous or specific, bilateral salpingectomy is the wiser procedure; otherwise, unilateral removal of the affected tube will suffice, or sometimes the mere release of adhesions. Hysterectomy should not be done routinely, but only if the uterus is directly implicated in the infectious process, if it is myomatous or otherwise diseased, or if it is so denuded during operation that a useless organ would be left. That is, it should be removed on intrinsic indications and not because extrinsic disease happens to be present.

The same plan should be followed with the ovaries. I am aware that their conservation under such circumstances is still a matter of debate, but personally I believe that every effort should be made to save ovarian tissue. Naturally they must be removed if they are directly implicated in the infectious process, if they are riddled with cysts, or if the circulation cannot be preserved intact. Usually, however, they are not inherently diseased, they have simply been in bad company, and even if the other genital organs must be removed, their



conservation is still warranted. We have no present evidence that the ovaries cease entirely to function at any portion of a woman's life, and if they do nothing more than supply internal secretion to the host they still should be preserved when possible. If extensive resection is necessary, I might add, transplantation is a preferable procedure; its field is limited, but I have more than once seen it avert the trying symptoms of a precipitate menopause in young women.

In this brief paper it has naturally been impossible to handle all phases of the subject, but I hope I have succeeded in making at least one point clear, that salpingitis is an infectious disease in which auto-sterilization will occur under expectant treatment in the great majority of cases and in which a spontaneous cure, at least clinically, is possible in a very fair majority. There is no indication, therefore, for immediate surgery in any case and often there is no indication for delayed surgery either. The patient has a right to her chance to preserve her sexual apparatus and it is unfair to deprive her of it. If surgery must eventually be done, if after a reasonable trial it is clear that a complete cure cannot be hoped for, then let the operation be radical enough actually to cure the disease, being sure, however, that this ruthlessness is not extended to organs which are not intrinsically involved in the infectious process. In tubal disease almost more than in any pathology of the female pelvis, the sanest surgeon, the wisest gynecologist is he who refrains longest from the practice of his art, but who, when he is obliged to exercise it, tempers his conservatism with sufficient radicalism to ensure for his patient a permanent cure.

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Seckinger, D. L., and Snyder, F. F.: *Cyclic Changes in the Spontaneous Contractions of the Human Fallopian Tube*. Bulletin Johns Hopkins Hospital, 1926, xxxix, 371.

The cyclic changes in the activity of the muscular wall of the tube closely parallel chronologically the histologic changes occurring in the endometrium and tubal mucosa during the reproductive cycle as follows: During the mid- and late-interval stage, there are rapid contractions showing a marked variation in amplitude. During the premenstrual and menstrual phase, slow contractions of uniform amplitude are found. During pregnancy tubal contractions remain slow and of uniform amplitude.

Comparison with other mammals suggests that in the human the increased activity of the tubal wall during the mid- and late-interval stage is probably coincident with the passing of the ovum through the tube.

No change in the number or activity of the cilia lining the tube was noted at any phase of the reproductive cycle.

C. O. MALAND.

## THE DIAGNOSIS OF FETAL DEFORMITIES IN UTERO\*

BY FREDERICK HOWARD FALLS, M.S., M.D., CHICAGO, ILL.

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THE purpose of this paper is to present certain facts observed in the study of a series of deformed fetuses in utero and to formulate, if possible, a syndrome that will be of use in the diagnosis of these cases.

The diagnosis of a deformed fetus in utero is not new, but it is only in recent years with the development of the x-ray that the clinical impression of the probability of a fetal deformity in a given case could be absolutely confirmed. As early as 1883 Laulaigne<sup>1</sup> described a syndrome based on four rules Pinard had laid down which included: permanent exaggerated tension of the uterus; difficulty in finding the fetal poles; weak heart tones; easy and exaggerated ballottement.

Negri<sup>2</sup> in 1899 reported two cases and Viana<sup>3</sup> in 1905 two more cases in one of which he was able to produce the convulsive movements of the limbs and presenting part by palpation in spite of the attendant hydramnios. Gilio<sup>4</sup> in 1896 stressed the syphilitic history, the abnormal movements, a transient albuminuria, vaginal examination during labor, weak and uncertain heart tones which he ascribes to poor cardiac innervation. The tentative diagnosis made by these writers was confirmed after the birth of anencephalic monsters. By means of our modern methods the diagnosis may be confirmed before the birth of the fetus. Furthermore, other deformities in addition to anencephalic monsters have been diagnosed in utero in recent years.

Accurate diagnosis is the more important since on it the decision of the obstetrician must be based as to what line of treatment shall be pursued, and its probable effect on two patients instead of one. In certain instances it may seem wise to increase the risk for one in order to reduce the danger for the other. A correct estimate of the condition of both patients at the time the decision has to be made, therefore, is of paramount importance.

The decision as far as the mother is concerned is based on a careful physical examination together with accurate special tests of the excreta, blood and the application of specially devised instruments such as the ophthalmoscope, cystoscope, and sphygmomanometer, x-ray, etc. By these means and others, especially if the findings can be supplemented by careful clinical observation for a period of a few days or weeks, a fairly satisfactory estimate of the condition of the mother can be determined.

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\*Read before the Chicago Gynecological Society, Jan. 20, 1928.

Our opportunity to judge of the condition of the fetus, on the other hand is far less favorable. The ordinary means of palpation, percussion and auscultation are only applicable to a limited degree even in the most favorable subjects. In patients with abnormally fat abdominal walls, an early pregnancy, irritable uterus, or hydramnios, these methods may be quite useless. The application of special function tests is obviously out of the question.

One of the most valuable of the diagnostic aids in this connection is the x-ray. The use of the x-ray in the diagnosis of obstetric conditions was somewhat limited in the early years of its development and before the use of the Bucky diaphragm by the fact that clear pictures were difficult to obtain owing to the thickness of the abdominal and uterine walls, and the liquor amnii which interferes with the proper penetration of the rays. Formerly it was thought that care was necessary to avoid injuring the growing embryo by the x-ray. This danger is, however, theoretical rather than real, as pointed out by Case<sup>5</sup> because of the short exposures necessary with the present technic.

There are a group of cases which are particularly difficult to diagnose by ordinary clinical methods and which are usually not diagnosed until late in labor or after the birth of the baby. These are the various types of fetal deformities which are relatively frequently associated with an hydramnios which obscures the physical findings.

It is particularly important to make a diagnosis previous to delivery in these cases for several reasons. In the first place the shock to the mother and family can be made less if a responsible member can be acquainted with the facts in the case before the birth of the child. Secondly, the discomfort of the patient due to the continuation of pregnancy in the presence of hydramnios may be relieved by inducing labor. Thirdly, the confidence of the patient in the skill of the medical attendant is increased by the proof of his diagnostic ability. Fourthly, if for any reason cesarean section or other operative intervention should be indicated in a given case, the presence of the fetal deformities should be given due consideration. Fifthly, the danger of postpartum hemorrhage due to overdistention of the uterus by the hydramnios may be minimized by induction of labor as soon as the condition is diagnosed and proper preparations may be made to treat this complication if it occurs.

Our interest was first aroused in the subject of x-ray diagnosis of abnormal fetal conditions by the diagnosis which we made and reported in 1917 of a fetus in opisthotonus position. All attempts to correct the position failed before labor set in. Following the rupture of the membranes at the end of the first stage, the fetus died before a version and extraction could be done.

The earliest reference we are able to find in use of the x-ray in the diagnoses of intrauterine pregnancy is by Albert,<sup>7</sup> 1899 at a meeting of the German Society

of Gynecologists. He showed a number of roentgenograms in which the fetal heads and some of the bones could be clearly seen.

H. Freund<sup>8</sup> in 1905 stated that the fetal skeleton was not visible until the second half of pregnancy, but he believed in the possibility of recognizing deformed fetuses, although he reports none.

Von Jaksch<sup>9</sup> in 1911 stated that he had repeatedly succeeded in visualizing the gravid uterus from the second month. He used metal filters and rather hard tubes, the time of exposure being from twelve to fifteen seconds. He also said the roentgen exposures were harmless as far as the pregnancy was concerned.

Lars Edling<sup>10</sup> in 1912 stated that the diagnosis in the early stages of pregnancy depended on the state of ossification, which was usually sufficiently complete during the third month. In most cases only parts of the skeleton could be seen. He also reported a case where the roentgen examination failed to diagnose an existing pregnancy. He believed hydrocephalus and certain double monstrosities could be roentgenologically recognized, although he did not examine any such cases. He had a successful roentgen of twins, except that it proved to be triplets which he failed to notice.

Spangler<sup>11</sup> in 1924 reported two anencephalic monsters, the first of these delivered February 6, 1921. The diagnosis was made because a marked hydramnios interfered with the palpation of the presenting part. The x-ray revealed "no fetal cranial bones, vertebrae very poorly developed, length of spinal column less than normal, with the bones of the face close to the thorax."

The second case developed a severe toxemia of pregnancy, a blood pressure of one hundred forty systolic, one hundred ten diastolic. The uterus at eight months was not so large as it should have been and x-ray taken because of this discrepancy revealed anencephaly with marked shortening of the vertebral column. This baby was stillborn and delivered January 20, 1923.

Campbell and Willits<sup>12</sup> in the same year reported an anencephalic monster which was diagnosed in 1923. This diagnosis was made by palpating a soft mass surrounded by a hard oval ring with the finger introduced through the cervix of the uterus.

Daub<sup>13</sup> in 1925 reported an anencephalic monster born January 3, 1924. The patient had a marked hydramnios and because the fetus could not be palpated she was referred to x-ray. The latter disclosed a well developed anencephalic monster and a defect in the upper portion of the spinal column which he regarded as a spina bifida. In August of the same year he examined another patient with a moderate hydramnios which revealed no malformation except a lack of development of the skull bones which gave the impression of an anencephalic fetus.

Daub<sup>13</sup> in 1926 reported a hydrocephalus which was examined with x-ray about the seventh month because of breech presentation. The skull appeared to be normal at this time. During the ninth month a large mass was felt in the region of the fetal head and by means of a second x-ray a definite diagnosis of hydrocephalus was made. This is the first diagnosis of hydrocephalus in utero that we have been able to find.

Rudolph<sup>14</sup> delivered a case in May 16, 1925 of a thirty-two day postmature anencephalic monster weighing nine and a half pounds. Great difficulty was experienced in bringing on labor pains in this case. A marked hydramnios interfered with the abdominal examination, rectal and vaginal examinations failed to make a definite diagnosis of presentation and position and aroused the suspicion of the possibility of a deformity of the fetus. An x-ray revealed the anencephalic nature of the deformity.

Case in 1926 reported three additional cases. The first case was referred for x-ray examination because of marked hydramnios interfering with the diagnosis of the position of the fetus. The cranial vault was found to be absent. The

second case also presented herself with a marked hydramnios which interfered with palpatory findings. The x-ray pictures revealed an anencephalic monster. The third case showed the uterus enlarged to the size of a full-term pregnancy when according to her history she was only about seven months pregnant. The head could not be palpated and the fetal heart tones could not be heard. A vaginal examination disclosed slight dilatation of the cervix through which with one finger it was possible to feel what was thought to be the rough edges of a fetal abnormality. An x-ray examination showed cephalic presentation and an anencephalic monster.

Lascano<sup>15</sup> in 1923 reported a case of anencephalus diagnosed in utero by means of palpation through the cervix alone. Thoms<sup>16</sup> and Ballard<sup>17</sup> each report a similar case.

Our attention was first called to the possibility of diagnosing monstrosities in utero by a report of Case of Battle Creek, Michigan, before this Society in 1917. He took an x-ray picture of an anencephalic monster in utero after abdominal and vaginal examinations had failed to determine the diagnosis and aroused the suspicion that the head was abnormal. The x-ray plate demonstrated the deficiency in the cranial vault clearly. No heart tones were heard and a second picture a month later revealed the same findings without evident growth of the fetus. Labor was induced and a 27 centimeter anencephalic monster was delivered.

We became interested in the subject and in 1921 observed our first case. Following this we observed three other anencephalic monstrosities and during the last year have observed a very interesting double headed monster, a spina bifida, and two hydrocephalic monsters.

In those cases showing an anencephalic monster a greater or less degree of hydramnios is usually present. When this is extreme no accurate palpatory findings can be noted. Even when the hydramnios is not great, or the membranes have ruptured, difficulty will be encountered in definitely locating the fetal head, since the normal hard round smooth object is absent, and the difficulty is increased if the head is in the fundus of the uterus.

On executing the fourth maneuver of Leopold in cephalic presentations no cephalic prominence will be noted. We noted lively movements of the fetus in our cases but did not elicit the abnormal spasmodic movements described by Pinard, Laulaigne, and others. We did not know of this sign when studying our cases.

On vaginal examination it may be difficult to determine whether the head or breech is presenting until after the partial dilatation of the cervix and rupture of the membranes. The soft meningocele may exactly simulate the breech. Frequently the diagnosis is not made until the head is on the perineum. The soft meningocele surrounded by the bony edge of the defective cranial vault has been said to be characteristic. In one of our patients the face presentation did not permit of this observation.

Another vaginal finding which is said to be characteristic and which we have been able to confirm has been the elongated form of the bag of waters protruding through the cervix after 4 or 5 centimeter dilatation.

When no x-ray is available and the diagnosis of anencephalic monsters is probable from the abdominal examination, it is possible to confirm the diagnosis by placing the patient under general anesthesia and introducing a finger or, after complete dilatation of the cervix and rupture of the membranes, the whole hand into the uterus. The deformity of the head can thus be easily appreciated. The heart tones are frequently found to be unduly rapid or unduly slow with and following labor pains before the head is engaged. Occasionally irregularity of rate is noted before labor starts. The probable explanation of this is that the medulla, unprotected by the bones of the cranial vault, is irritated by the increased intrauterine pressure resulting in stimulation of the cardiac centers. The point of maximum intensity of the fetal heart tones was noted to be unusually low in the abdomen as compared with those of the normal fetus with the same degree of engagement of the head as determined by rectal or vaginal examination. This is due to the lack of the cranial vault and the shortness of the neck. Rates varying from forty to one hundred and seventy and higher have been observed. There may be considerable difficulty in hearing and counting the heart tones due to the muffling by the liquor amnii.

The x-ray picture will usually show the deformity after the seventh month of gestation, and although the outline of the fetus and the skull may be somewhat obscured by the hydramnios it should show the defect in the cranial bones. The contrast with the rounded vault of the normal head is easily appreciated.

A study of the family history was not of value in any of these cases, there having been no similar monstrosities born in these families as far as the patients knew. This is somewhat against the general impression that monstrosities tend to occur in families, and to repeat in the same patient.

The treatment of this condition is the termination of the pregnancy in the most conservative manner as soon as the diagnosis is made. Induction of labor by Watson's method may be tried and failing the procedure may be repeated after a rest of three or four days. If it again fails a bag induction may be advised. This is particularly desirable if the hydramnios is severe enough to cause pressure symptoms. The rupture of the membranes before inserting the bag and draining off a large part of the liquor, may assist in developing strong contractions. If any unusual obstruction is offered by the bony pelvis, craniotomy or embryotomy should be undertaken as soon as normal parturition is interfered with. If such a baby is born alive as

they not infrequently are, the chance of its surviving for more than a few days is very remote. It is best to keep it separated from the mother, and to withhold the diagnosis from her when feasible, simply telling her that the baby did not survive the labor. The information, of course, should be given to the husband or some responsible member of the family as soon as the diagnosis is made and confirmed. The baby should be kept warm and sterile dressings over the meningocele. In spite of such precautions a meningitis will almost surely develop if the baby does not die of inanition.

Whenever in a given case for various indications such as contracted pelvis, or abnormalities of the pelvic soft parts, a cesarean section may be considered the choice of operation for delivery, if there is any suspicion of fetal abnormalities, careful x-ray examination should be made before electing this operation. It is not justifiable to jeopardize the mother for such a baby.

The following case histories are presented:

CASE 1.—F. L., entered the obstetric department of the State University of Iowa on December 13, 1921, young, well nourished, white, aged nineteen, a school teacher and not married. Menses began at twelve years, were regular every twenty-eight days, lasting five to seven days, flowed an average amount with occasional pain. She denied previous pregnancies. Her last period was April, 1921. She admitted a single intercourse the last of March, 1921.

She had had measles, chicken pox, and whooping cough, scarlet fever in 1914, influenza in 1918, and smallpox vaccination in 1915. She had had a sore throat three weeks before admission and her hands and ankles had been somewhat swollen for three weeks. The digestive, nervous, and genitourinary systems were negative except as previously noted. There was no family history of carcinoma, Bright's disease, diabetes, or tuberculosis. Her mother had no abnormalities in her obstetric history as far as the patient knew. Heart and lungs normal. No glandular dystrophy. Breasts normal in contour and secretion. Slight edema of the lower extremities. The abdomen was greatly distended and tense. Fetal heart tones not heard and fetal parts not clearly outlined. Fetal movements, however, could be heard and felt and seemed to be unusually active. Rectal examination revealed a small part presenting and the cervix almost completely effaced but not dilated. The pelvic measurements normal. Vaginal and urethral smears were negative for the gonococci. The Wassermann test was negative. Urine was amber color, specific gravity 1018, no sugar, no albumin, many pus cells. Blood pressure varied from 150 to 180.

On December 18, the patient complained of irregular pains during the night, and at eleven A.M. discharged from the vagina what seemed to be amniotic fluid. Rectal examination revealed no dilatation, pains every ten minutes but weak. Fetal heart tones heard but not counted. Labor continued about the same all day, and practically stopped by midnight.

January 2, she began again to have pains at 11 A.M. and was taken to the delivery room with two fingers' dilatation. Fetal movements were easily stimulated and visible in the lower left and the upper right quadrants. Fetal heart 144 and irregular. X-ray revealed an anencephalic monster, cephalic presentation. Membranes ruptured at 5:40 P.M. and about three gallons of amniotic fluid were expelled. Before rupture the elongated shape of the bag of waters was noted.

Spontaneous delivery occurred at 6:40 P.M. of an anencephalic monster weighing four pounds and eight ounces. The heart beat for five minutes but the baby did not breathe. Estimated blood loss was 200 c.c. The placenta contained numerous small infarcts and there was a marginal insertion of the umbilical cord. The cord itself showed numerous twists. The puerperium was uneventful except for a mild thrombophlebitis of the left leg.

CASE 2.—G. S., primipara, single, aged nineteen years. Entered the clinic August 31, 1923. Nothing of importance in the family history. She had had diphtheria, and infantile paralysis with a deformity of the right foot. The tonsils and adenoids were removed at seventeen. Menses began at fifteen years, regular every twenty-eight days, lasted five days, moderate, no pains. The father of the baby weighed one hundred and fifty pounds, twenty years of age, white, laborer, and nothing was known as to whether he had venereal disease or tuberculosis. She thought her last period had been in November, 1922, and that she had felt quickening March 17, 1923.

General examination was negative except for the deformity of the right foot. Presenting part was thought to be the breech, sacrum right anterior, and it was thought it had advanced to about seven and one-half months. The fetal heart tones were clear, 132. Pelvic measurements were slightly smaller than normal. It was difficult to palpate the head because of mild hydramnios present. X-ray taken August 8, 1923 showed an anencephalic monster. Blood Wassermann was negative to both alcoholic and cholesterinized antigens. The urine was quite clear, and blood pressure ranged from 130 to 166.

She went into labor September 24, at six o'clock in the evening. Ovoid was longitudinal, head over the inlet, breech in the fundus, back to the left, shoulder low over the pubis. The baby was estimated to weigh six pounds. Fetal heart tones ranged from 138 to 144 throughout the first stage. The second stage began at one o'clock in the morning, and at two twenty the fetal heart tones fell from 138 to 40 and most of the time were around 100. The pains were strong. The birth was spontaneous, cephalic. The third stage was rapid. The baby was an anencephalic monster, which lived eight hours and ten minutes.

CASE 3.—N. K., primipara, married, twenty-five years of age. No history of monstrosities in the family. No chronic diseases in the family. She had the ordinary diseases of childhood. Was operated on for appendicitis on May 16, 1923, in the early part of this pregnancy. Otherwise in good health. Menses began at thirteen, regular every twenty-eight days, lasted two or three days, scant and always painful. No miscarriages. Father of the baby was five feet four inches tall, weighed one hundred and thirty-five pounds, forty years of age, white, laborer, denied venereal disease or tuberculosis.

The first day of the last period was March 12. She felt quickening July 1. Blood pressure was 110 systolic, 65 diastolic. General examination was negative. Fundus was halfway between the umbilicus and the xyphoid on November 17, 1923. The presenting part could not be made out but it was thought to be a head. Fetal heart in the left lower quadrant, rate 130. Measurements were normal. Blood Wassermann negative to alcoholic and cholesterinized antigens. X-ray was not taken in this case since the diagnosis was not suspected. There was no hydramnios present.

She went into labor December 6, at five-thirty P.M. Ovoid longitudinal, inlet moderate, breech in fundus, back to the right. Fetal heart irregular, varying in the first stage from 164 to 120, sometimes clearly audible. Eight rectal examinations were made between five P.M. December 6, and eight forty A.M. December 7. Presentation was at first thought to be breech, then was changed to a brow, and then to a face. During the second stage, which began at five P.M. on December 7,



the heart tones varied from 148 to 69, and were poor in quality. Anencephalic monster was stillborn after one hour and forty minutes in the second stage. The placenta and membranes were apparently normal.

CASE 4.—G. S., primipara, fifteen years of age, single, white, entered the clinic August 15, 1925. Wassermann was negative. Family history for twins or monstrosities negative. The patient had had measles, mumps, chicken pox, influenza and malaria, tonsils normal to date. Menstruated at eleven and one-half years of age, every twenty-eight days, lasting three to four days, moderate in amount, no pain. The father of the baby was her stepbrother, healthy, five feet tall, weighed one hundred eighty pounds, a high school student.

There were no toxic symptoms and her heart, lungs, teeth, nervous system were negative. There was slight edema. She was stocky, five feet tall, weighed one hundred and eighteen pounds, the breasts showed colostrum, and the position of the baby was L.O.A. The size of the abdomen was slightly more than eight months, and the fetal heart tones were 140. Pelvic measurements normal.

Labor began September 18, 1925 at eight A.M. Blood pressure was 115/75. Ovoid longitudinal, head over the inlet, but it was a questionable diagnosis. X-ray taken August 18, 1925 showed an absence of the fetal head. The baby weighed 2170 grams, and was 45 cm. in length. Heart tones irregular, varied from 100 to 160 during the first stage, and went as low as fifty-six during the second stage. The baby was born alive, brow right anterior and was very weak and listless. The placenta was small; 100 c.c. of blood lost. No hydramnios was noted, and the fetal heart tones had only one sound. The heart tones before labor were found in the midline and most clearly just above the symphysis. The baby lived three days.

CASE 5.—A. S., entered the hospital March 7, 1925 in the second stage of labor with the bag of waters ruptured, and a foot presenting. The patient was seventeen years of age, primipara, with a negative family history for twins or other monstrosities. Patient had had all of the ordinary diseases of childhood, scarlet fever, and influenza in 1918, and had frequent attacks of tonsillitis and sore throat. No miscarriages. No history was obtainable about the father of the baby. She had slight edema and some dizziness. Weighed one hundred and forty-six pounds.

Pains began March 7, 1925 at ten A.M. and the bag of waters ruptured at one fifteen P.M. She entered the clinic at two-thirty with the fetal foot protruding, no heart tones were heard. Pains were strong, and the fetus was born dead at two fifty-five. Placenta was complete with an eccentrically implanted cord. 400 c.c. of blood was lost.

CASE 6.—N. S., white American female, aged twenty, married, para i. Felt quickening in March. At term September 30, 1927. Her period in December lasted only one and a half days, instead of the usual four or five days, therefore, her last regular period was in November. She had the usual vomiting in January and February. She had marked edema one week before entering the hospital. Had slight dizziness and vomiting two weeks before admission. Also some gastric pain.

Menses began at fifteen, irregular, lasted for five days, small in amount and painful. Had influenza in 1918, no surgical operations. Mother had carcinoma of the stomach, father died of tuberculosis, two sisters and four brothers alive and well. Patient is a twin, also her cousin has twins. Father of the baby is five feet seven inches tall, weighs one hundred and thirty-seven pounds, twenty-two years of age, laborer, denies venereal diseases.

Patient entered the Out-Patient Department April 4, 1927, at which time the diagnosis of pregnancy, duration twenty-three weeks, cephalic presentation was made

and no heart tones were heard. A month later the heart tones were heard, rate 140, and the diagnosis of cephalic presentation L.O.A. was made. On July twenty-third twins presenting by the breech was diagnosed, and she was sent to x-ray for confirmation. The x-ray picture was diagnosed twin pregnancy about six or seven months presenting by the breech. Two heads were found in the right iliac fossa and the spines indefinite and in close approximation to each other. Monstrosity was suspected and a second x-ray was taken a week later and a dicephalic monster diagnosed.

On September 7, 1927 she had considerable bleeding and was ordered into the hospital. Heart and lungs normal. Fetal heart varied from 124 to 156. On entering the hospital she was found to have a breech presentation, slightly movable, fetal heart 128. There was no cervical dilatation, the os was thick and the presenting part not engaged. The patient was having some pain in the lower abdomen and had lost about two to three ounces of blood. On September 8 she lost about another ounce and continued to ooze thereafter. Fetal heart irregular, from 136 to 160. A diagnosis of placenta previa was made and because she was a primipara and also because of the difficulty anticipated in the delivery of the double head in the presence of a placenta previa and a preeclamptic toxemia, a cesarean section was elected. The blood pressure during her stay in the hospital had risen from 98 to 194 systolic.

Classic cesarean section done September 12, 1927, indications were a slightly contracted pelvis, a marginal or possibly a lateral placenta previa in a primipara, together with a double headed monster and a mild preeclamptic toxemia. It was done in the usual way, slight increased difficulty was experienced removing the fetus from the uterus especially with the shoulders and heads. The placenta was delivered following the birth of the baby, was normal in appearance, one amnion and chorion. It seemed to be implanted in the lower uterine segment but whether marginal or lateral type of placenta previa could not be determined. The baby was a dicephalic monster.

A dissection of the specimen revealed a duplication of the structures of the head and neck, together with two spinal columns. There was only one heart, and four lungs in four plural cavities. The abdominal viscera were normal in number and size as were the extremities. A detailed description of the specimen will be given in another report. The length of the fetus was forty-one centimeters and it weighed 2690 grams.

CASE 7.—White, American, aged nineteen. She was sent in from the Out-Patient Dispensary because of high blood pressure January 22, 1927. Her last menstrual period was April thirteenth, and she had no special toxic symptoms. Her menstrual history began at twelve, moderate every twenty-eight days, flowed five days, few cramps. She had had no previous pregnancies. She had measles, mumps, chicken pox, and influenza. No history of twins or monstrosities in the family. Her husband was twenty-five years of age, six feet tall, weighed one hundred and eighty-five pounds, laborer.

Physical examination showed an obese, white female, weighing two hundred and fifty pounds. General physical examination was negative. Abdominal examination revealed thick walls, obese, no scars or hernia. The fundus of the uterus was two fingers' below the xyphoid, irritable, and there was more than the usual amount of liquor amnii. Because of the softness of the head, the thickness of the abdominal wall, and the mild hydramnios a breech presentation was suspected. The x-ray examination on January twenty-fourth revealed the unusual size of the head together with the defect in the lumbar spine. Abdominal palpation was seriously handicapped by the stoutness of the patient. The unusual size of the head was not easy to detect

by palpation, even after the x-ray had made the diagnosis. The position was right occiput-anterior, and the head was movable. The pelvic measurements were: interspinous 31.5, intercrural 36, bitrochanteric 47, Baudelocque 27. The blood pressure was 148/104. The phenolsulphonaphthalein test was done and the dye appeared in twenty-two minutes, forty-two per cent was recovered in the first hour and eight per cent the second, or fifty per cent for the total for two hours. The Wassermann and Kahn tests were negative. The blood chemistry was normal for alterations of the sugar, nonprotein nitrogen, uric acid, urea, and creatinine. Urine showed no albumin, no casts, sugar was positive.

Watson's method of inducing labor was tried January 25, 1927 but failed, and on the twenty-seventh it was tried again and failed. On the twenty-ninth the patient went into weak labor with a blood pressure of 172/120, position R. O. A. Fetal heart 140. On the thirtieth, the pressure was 160/110, position R. O. A. heart tones could not be well heard, and the pains were weak and inefficient. On the thirty-first the pressure was 194/124, pains coming every two minutes, position R. O. A. the head engaged. On the thirty-first at one-thirty A.M. the pains became more severe, every two minutes, head engaged, heart tones 136. At seven A.M. the blood pressure was 160/120, pains every minute, R. O. A., head engaged, fetal heart tones 150, irregular. The baby was born spontaneously, male hydrocephalic infant, showing spina bifida, weighed 3900 grams, fifty-four centimeters long and could not be resuscitated.

CASE 8.—Patient twenty-six years of age, para iii, colored. She was admitted on February 22, 1927 at twelve A.M. with blood pressure 140/112. Contractions fair, pains every five minutes, fetal heart 160. Rectal examination showed the cervix not dilated, membranes intact, presentation and position not made out. The presenting part was not engaged. The pains were weak and inefficient, persisted for forty-eight hours. Fetal heart 160, regular. An x-ray was taken on the twenty-fourth, the report, a normal fetus. Slight labor pains on the night of the twenty-fifth and twenty-sixth. Fetal heart tones dropped to 140. There were no labor pains from the twenty-seventh to the thirty-first, when interrupted pains began.

On April 1, 1927 about 1 P.M. because the pains were dying down and had been weak and inefficient, the membranes were ruptured and fourteen pints of liquor amnii drained off. Heart sounds 120 after the rupture. In order to let out all of the liquor amnii the resident pushed up on the head and this produced a transverse presentation which turned spontaneously to a breech. The heart tones became irregular about four P.M. varying from 76 to 116. An x-ray picture taken at this time revealed the breech presentation and the head was thought to be normal. Clinically, however, the head seemed to be larger than normal and softer. Because of the x-ray report and the bad heart tones we felt a rapid delivery should be undertaken to give the baby the benefit of the doubt. The cervix was dilated by the Harris method and the fetus was extracted until the head engaged in the inlet.

Despite the application of considerable traction the head would not come through the inlet. Examination clearly showed the disproportion between the head and the inlet and the cardiac action had ceased. Therefore, a craniotomy was done on the after-coming head. The baby weighed five pounds six and one-half ounces without the brain. The placenta measured nine by six inches, the cord was eccentrically implanted, twelve inches long, and the membranes were ruptured laterally. The placenta was intact containing occasional white infarcts. The sutures and fontanelles were wide and unmistakable evidence of hydrocephalus was found.

In addition to these cases we have delivered two fetuses in the clinic with spina bifida in which the deformity was entirely unsus-

pected before delivery. In Case 10 the presence of a marked hydramnios should have prompted the taking of an x-ray picture but this was not done.

CASE 9.—Patient thirty-one years, colored, para iv. She was referred from the Chicago Lying-in Dispensary on February 8, 1927 because of cardiac and venereal disease. A diagnosis of nephritic toxemia was made. She entered the clinic February 8 and was estimated to be due about the middle of February. There was a history for the last six months of cough, swelling of the ankles and inability to lie down. She lost her first and second babies in 1921 and 1922 and was told she had kidney trouble. Her last baby was born alive, weighed five pounds ten ounces. Menses began at twelve, regular twenty-eight days, and flow lasted four days, moderate in amount, some cramps the first two days. She denied gonorrhea and syphilis. The past medical history was positive for measles, mumps, whooping cough, and chicken pox, and she had frequent attacks of sore throat and rheumatism during the previous year which lasted three or four days. She denied scarlet fever and had had no surgical operations. The general examination was negative as far as the head, neck, and glands were concerned. The lungs showed pulmonary edema, patient's abdomen was enlarged, the heart was badly decompensated and the pulse 108. The fundus of the uterus was below the xyphoid, and the uterus was not irritable. The fetus was in L. O. A. position. Fetal heart heard in the lower left quadrant rate 144. There was nothing in the findings or history of this case to make one suspect an abnormality of the fetus. Blood pressure was 172/130 and the phenolsulphonaphthalein test was forty-five per cent in two hours.

She was given digitalis and between the eleventh and seventeenth, she improved steadily and on the eighteenth a Voorhees bag was inserted which was expelled in six hours, and on April 29 a macerated fetus was extracted which showed a small spina bifida in the lower lumbar region. It weighed four pounds and one ounce and was forty-five centimeters long.

CASE 10.—White, American, para i, illegitimately pregnant, was estimated to be due May 21, 1927. There had been no abnormal pregnancies in her family history and her menstrual history was negative. She had tonsillitis every winter until eleven years of age and had a tonsillectomy in 1921. She had had measles, mumps, and scarlet fever as a child, denied venereal disease. The father of the baby was five feet nine inches tall, weighed one hundred seventy pounds, a mechanic, twenty-one years of age, had no tuberculosis.

The physical examination was essentially negative. The first examination showed a marked hydramnios and the fetal parts could not be palpated easily. The fetal heart tones were 140 and heard in lower left quadrant. There was no suspicion from these findings that there was anything abnormal about the case, therefore, an x-ray was not taken. The patient went into labor November 17, 1927 and delivered a full time baby forty-nine centimeters long which had a spina bifida and a club foot.

With the exception of the hydramnios in Case 10 the symptoms in both cases of spina bifida were entirely negative.

The appearance and delivery of these monstrosities in our clinic where the interest in this subject has been considerably stimulated by the previously mentioned cases, demonstrates the difficulty of diagnosing this type of deformity unless a chance x-ray picture is made for some other indication.

From a study of the case histories in which the information regarding previous infection in these cases was noted it will be seen that syphilis as gauged by the Wassermann reaction was rarely present. This was diametrically opposed to the experience of Gilio. On the other hand we have noted a large number of acute infectious diseases in the cases that we have studied. Influenza, measles, mumps, pneumonia, smallpox, scarlet fever, and other serious systemic infections have occurred. The possibility at once suggests itself that there might be some etiologic connection. It is certainly conceivable that these serious infections might have some deleterious effect on the dormant egg cell in the ovary, and result in abnormal development after fertilization.

The associated lumbar spina bifida in one case, which as far as we know is the only lesion of this kind reported up to the present time, can also be clearly seen. The bones of the fetal skeleton are somewhat obscured by the associated hydramnios. One case of hydrocephalus of a less marked degree could not be accurately diagnosed even with two x-ray pictures. The deformity of spina bifida alone gives so few signs and symptoms that its presence is rarely suspected in utero.

#### CONCLUSIONS

From a clinical study of the foregoing cases it would seem that the following signs and symptoms when present in a given case are strongly suggestive of a deformed fetus in utero:

1. Hydramnios coming on usually about the seventh month and associated with permanent exaggerated uterine tension and easy ballottement is suggestive of fetal abnormality. This condition is not constant with fetal deformities.

2. Inability definitely to outline the fetal head suggests anencephalus while abnormal size or consistency indicates hydrocephalus.

3. Difficulty is experienced in differentiating between the fetal poles either by abdominal or vaginal palpation when the deformity is anencephalus.

4. In anencephalic monsters a soft meningocele surrounded by a bony ring may be felt on vaginal examination with a finger inside of cervix in cephalic presentations.

5. Fetal heart tones are heard faintly or not at all when the hydramnios is marked. They are usually normal or rapid during pregnancy, but during labor they are often slow and irregular or abnormally fast. With cephalic presentations, in anencephalic monsters they are frequently heard unusually low in the abdomen during labor, and the irregularity is most marked in these cases.

6. Abnormally active fetal movements, which may become convulsive if pressure is made on the head in cases of anencephalic monsters, may be seen and felt.

7. X-ray pictures which will clearly determine the deformity as early as the sixth month, in anencephalic, hydrocephalic or spina bifida fetuses, but a negative picture does not rule out the possibility of a deformity.

The above points may serve as a syndrome for the diagnosis of these monstrosities in utero. We feel if they are carefully observed that the birth of these monstrosities undiagnosed will rarely occur.

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(For discussion, see page 894.)

## ARTIFICIAL PRODUCTION OF STERILITY

### WITH SPECIAL REFERENCE TO EXPERIMENTAL TEMPORARY STERILITY BIOLOGICALLY INDUCED IN THE FEMALE

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THE present-day method of defeating fertility in civilized communities is by the induction of abortion or the practice of contraception. That many pregnancies are prevented or terminated by artificial means is a well-recognized fact. Changing social conditions, by giving woman a definite status in the business world, have done much to discourage the natural function of childbearing. Many women who continue to work after marriage feel that their economic status will not allow them to resign their positions and therefore sacrifice or postpone motherhood. Another type of woman who frequently resorts to contraception or abortion, or both, is the mother of a large family who is weary of the obligations of rearing children and feels that she is entitled to a respite. Usually some one of the various methods of contraception is utilized; but, when this fails, abortion is generally induced.

The frequency with which abortions are performed is appalling. Professor V. S. Gruzdev,<sup>1</sup> of the University of Kazan, states that there is actually a pandemic of abortions spread all over the world, invad-

ing even the most remote rural districts. According to L. L. Okontchitz,<sup>2</sup> the percentage of abortions admitted to the Nadejdinsky Maternity Institute in 1903 was 7.5 per cent of all admissions; in 1912, it was 17 per cent; in 1923, 21 per cent. In 1926, 3,000, or 25 per cent, of the 12,000 admissions were for abortion.

From the data available in my files, I have compiled statistics in an endeavor to estimate the frequency with which women resort to abortion. The records of 13,800 women, 6,368 of whom were of functional age, were studied. Of these women, 1,974 gave history of 2,796 abortions, which in 2,730 cases were either admitted or assumed from the history to have been induced.

Aside from the moral aspect, the evil consequences of abortion to the patient herself are admitted. Death from perforation of the uterus, septic infection or uncontrollable hemorrhage is fairly common. Pelvic infections not proving fatal may result in years of semi-invalidism and also permanent sterility. The average woman is well aware of these dangers; but, when the infant is unwelcome, she is not deterred.

#### CONTRACEPTIVE METHODS UNSATISFACTORY

Birth control is a procedure which few mention but many practice. Especially is this true of the various means of contraception to which perhaps the majority of couples resort at some time or other during their married lives. The measures employed include coitus interruptus, condoms, douches, vaginal globules, pastes, sponges, vaginal and cervical occlusive pessaries, and even intrauterine injections. None of these methods of contraception is infallible. Some of them are uncertain; others, reliable but harmful in their effects on the nervous system because of the failure fully to consummate the sexual act; still others produce direct injury to the female sexual organs. All of them are decidedly inconvenient at times and do not permit of anything like normal sexual relations.

In view of the unsatisfactory status of contraceptive measures, and not as a means of furthering the Malthusian movement indiscriminately, we should strive to devise a safe method of inducing temporary sterility in the female where indicated for medical reasons only.

Under medical guidance, there could be no objection to the legitimate induction of temporary sterility in the female. If such a means were available, a tuberculous woman, for example, could be tided over the dangerous years of her illness. Should her health subsequently warrant motherhood, the condition of sterility could then be suspended.

Surgical methods of inducing sterility are open to serious objections. When successful, they are generally permanent and fertility cannot be restored subsequently, should the patient's improved health make this course desirable.





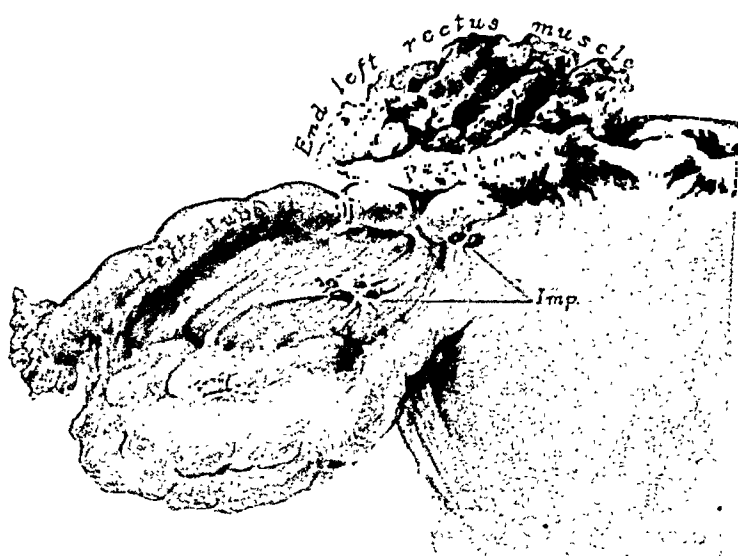


FIG. 36



FIG. 37



FIG. 38

Operations aiming to cut and tie the tubes have largely been unsatisfactory, because the stumps are likely to become pervious again at some subsequent time. The surest method of interrupting the passage of the ovum from the ovary to the uterus is by excising the uterine portion of the tube; but, after this operation, fertility cannot be restored.

Turenne<sup>3</sup> has described an ingenious operation to induce temporary sterility. He sutures the fimbriated end of each fallopian tube into a pocket made in the broad ligament. When it is desired to restore fertility, salpingostomy is performed and the lumen of the tube adjusted to the ovary as in the performance of classical salpingo-ovaropexy. Such procedure, however, involving two laparotomies in a woman who presumably is too weak to bear children, would not seem susceptible of employment on a large scale.

#### BIOLOGIC STERILITY

During the last few years, considerable research has been done with reference to the biologic prevention of conception in female animals. For this purpose, various measures have been employed, including injections of placental extracts and extracts of ovaries of pregnant animals, transplantation of ovaries of pregnant animals into healthy young females, and immunization by parenteral introduction of spermatozoa. The results with reference to the induction of temporary sterility have been most definite following injections of spermatozoa. This topic will therefore receive consideration first.

That animals react biologically to the introduction of seminal products and form a biochemical defense, has been clearly established. Farnum<sup>5</sup> in 1901 injected rabbits with semen in order to ascertain whether they are capable of elaborating specific precipitins for semen. He found that rabbits injected intraperitoneally with semen or testicular emulsion of dog, bull, or man develop specific antisemen-precipitins. Hektoen<sup>6</sup> in 1922 demonstrated that the injection of rabbits with human serum induces the formation of precipitins that are specific for human seminal proteins. Waldstein and Ekler<sup>7</sup> in 1913 were able to demonstrate that material from the seminal fluid is absorbed, at least in rabbits. Landsteiner<sup>8</sup> was the first to demonstrate the presence of spermattoxins in blood serum after parenteral introduction of spermatozoa, and his researches have been corroborated by others.

#### STERILITY PRODUCED BY SEMEN IMMUNIZATION

On clinical grounds, Vogt<sup>9</sup> believes that overloading with seminal products may lead to sterility and that natural fecundity is restored by prolonged abstinence from sexual intercourse. The first cohabitation is the one that is most frequently followed by pregnancy. This may be explained by the absence of immunity of spermatozoa, which is acquired only after intercourse. Van der Dyk states that the blood serum of sterile women in whom no other cause of sterility can be found always belongs to the agglutinating group. Although the assumption of sperm immunity is only a hypothesis, an influence from resorption of sperm has unquestionably been established. According to Mayer,<sup>10</sup> abortion of very young ova may result from frequent coitus after a long period of abstinence.

Tushnov<sup>11</sup> was one of the pioneers in this field. On the basis of his early experiments he asserted that temporary sterility may be induced in female animals by immunization with spermatozoa of a different species. He was very insistent on the use of heterogenous spermatozoa for inducing infertility. His work, like that of most subsequent investigators, showed the injections to be harmless.

Fogelson's results<sup>12</sup> in 1926 showed that we have an accurate method of temporarily inhibiting conception in rats by sensitizing the female to spermatozoa protein. Anello-Rabboni<sup>13</sup> observed sterility after introducing a freshly prepared extract of rabbit testes into doe rabbits. When an extract of guinea pig testes was used, sterilization was not obtained.

By injecting the semen of rabbits or of closely related species, Dittler<sup>14</sup> in 1920 rendered female rabbits sterile for varying periods of time according to the number of injections given. In order to eliminate the possibility of a primary sterility due to other causes, he employed only rabbits which had given birth to at least one litter. It is to be noted, however, that natural sterility in rabbits is rare and that the animals frequently become pregnant after a single copulation. In some cases, examination of the blood serum of the sterilized animals showed it to be definitely toxic to spermatozoa, causing agglutination and inhibiting their motility. Large doses of human semen failed to induce sterility in rabbits. Repeated laparotomies on the animals during the process of immunization against semen showed that the process of ovulation was going on normally. Except for the gradual loss of weight, the animals showed no ill effects from the repeated injections of semen. When numerous injections were given, this loss of weight was more marked. In two cases there was an actual cachexia with atrophy of the sex glands.

Castoro<sup>15</sup> in 1926, in guinea pigs, induced a period of temporary sterility by subcutaneous injections of the seminal products of male guinea pigs. The injections were well tolerated and no anaphylactic reactions were observed in any instance.

McCartney<sup>16</sup> in 1923 injected female rats subcutaneously with spermatozoa suspension. He found that the rats remained sterile for a period of from two to twenty-two weeks beyond the normal gestation time, although the normal sexual cycle and sex behavior of the animal seemed in no way altered. He concludes that the spermatoxins of the immunized animal are present in the vaginal and uterine secretions and have an agglutinating effect on the spermatozoa.

According to McCartney, the degree of immunity is proportional to the amount of spermatozoa suspension injected. After the immunity caused by the injection of the spermatozoa has worn off, the animal is again able to bear normal young.

Guyer<sup>17</sup> in 1922 demonstrated that when male rabbits and guinea pigs are injected intravenously with specific spermatoxic sera obtained from fowls or with the spermatozoa themselves, sterility results and the serum of the animal becomes spermatoxic.

Karasek<sup>18</sup> believes that immunization with spermatozoa offers a great advantage over the usual methods of sterilization now in vogue, since it involves no permanent injury to the sex organs or the body as a whole. Aside from fertilization, it may eventually be proved that the female organism is influenced for the good by absorption of seminal products. Rosenfeld<sup>19</sup> in 1926 reported the results of repeatedly injecting human semen containing spermatozoa into three women. A definite positive test for a spermatoxic principle was not demonstrable, although a complement-binding body was clearly identified. Rosenfeld suggests that it may be possible to regulate the injections so that a sufficient quantity of spermatoxic substance will always be present in the serum.

Bodnar and Kamniker<sup>20</sup> reported tests on the blood serum of one hundred women to determine the effect of the serum on the viability of spermatozoa. They

do not believe that their findings indicate that a diagnosis of "immunity to spermatozoa" can be made by serologic methods in cases of sterility.

Oslund,<sup>21</sup> in 1926, claimed that the delay in pregnancy occasionally found after sperm injection is of short duration and is probably caused by physical disturbances of the body rather than antibody reactions, also that some of the delayed pregnancies reported in the literature were probably due to breeding conditions. This view, however, is contrary to the work of most investigators.

Perhaps the most exhaustive experiments with reference to the biologic induction of temporary sterility in female animals have been performed by Kostromin and Kartashev,<sup>22</sup> of the Perm Institute of Bacteriology, in East Soviet Russia.

As this paper is very difficult to obtain and appears only in Russian, I thought it desirable to quote it at great length for the benefit of the average reader, to whom the material would not otherwise be available.

The government of Soviet Russia recognized economic distress as an indication for the prevention of conception and is sponsoring a considerable amount of research for the purpose of devising a biologic method of contraception applicable to women. In the United States, of course, we are not in sympathy with such a liberal use of contraceptive technic and believe that impregnation should be prevented only when the health of the woman demands this course. Nevertheless, while we cannot countenance the far too liberal application of the prevention of conception by biologic means advocated in Soviet Russia, we must admit that the results of the research work done for this purpose have great scientific value and that we may possibly utilize them to advantage for the control of impregnation under conditions set forth by the physician.

Kostromin and Kartashev began their experiments in 1924 and completed them in 1927. They injected female rabbits and guinea pigs with heterogenous spermatozoa, both living and dead, and obtained positive results in both cases. However, the results were better when living spermatozoa were used. They used spermatozoa from the bull for immunization of rabbits and guinea pigs; and from rabbits for the immunization of guinea pigs; and from guinea pigs for the immunization of rabbits. The experimental results reported by Kostromin and Kartashev are most impressive and offer much encouragement for the clinical application of biologic sterilization in the practice of gynecology. Certainly the results of the investigations so far reported are sufficiently convincing to justify further study with the hope of eventually placing at the disposal of the physician a simple, safe, and convenient method of inducing temporary sterility under circumstances when the onset of pregnancy would endanger the health of his patient. But we must be conservative. To quote an editorial<sup>24</sup> in the *Journal of the American Medical Association*, "Whether injection of spermatozoa or spermatotoxic serums may be used as a method of sterilization in human biology is a question of the future." Credit is due to Kolpikov<sup>23</sup> for the preparation of a standardized vaccine containing a definite number of spermatozoa.

#### STERILITY DUE TO OVARIAN TRANSPLANTS AND HORMONE INJECTIONS

Haberlandt<sup>25</sup> in 1921 attempted to produce temporary sterilization in female animals by transplanting the ovaries of gravid animals. Also experiments performed showed that it is possible to produce a hormonal sterilization of the females by subcutaneous injection of extract of ovaries of pregnant animals.<sup>26</sup> The sterile periods lasted one and a half to three months in rabbits and three to four weeks in guinea pigs. Haberlandt considers that this form of sterilization may be applied

as a therapeutic measure by employing injections of extract of ovary of pregnant animals in order to provide temporary sterilization for prophylactic or hygienic reasons. The ovaries of the treated animals contained numerous small follicles but no large mature ones. It therefore appeared that the treatment had brought about a great inhibition in the maturation of the follicles. Treatment with Abderhalden's placenta opton had the same effect, especially when the material was taken in the second half of pregnancy.

The inhibition took place in three stages: (1) The animal would not allow herself to be covered. (2) The animal could be covered but fertilization did not take place. (3) The animal became pregnant but the number of young was decreased. Haberlandt<sup>27</sup> showed that injections of corpus luteum do not have the effect of interfering with impregnation. In 1927 he produced temporary sterility in white mice by feeding them with ovarian or placental extract over a period of one or two months.<sup>28</sup> The sterility induced thereby lasted from one to two and a half months, which is a long time considering the short life of the white mouse. In some cases, the animals were rendered permanently sterile.

Köhler<sup>29</sup> attributes Haberlandt's experimental results to a nonspecific protein effect rather than hormone action. He injected female rabbits with various organic extracts, including mammary glands, kidney, testicle, and spleen extracts. He observed that the animals resisted intercourse after such injections and did not become pregnant. Whether the organic extract injected was prepared from the ovary or some other gland, temporary sterility was induced thereby in either case.

Greil<sup>30</sup> questions Haberlandt's work with reference to the production of sterility in animals by the implantation of ovaries of pregnant animals and the injection of ovarian extract from pregnant animals. He maintains that there is no proof that sterility in these cases was due to the action of a sex gland hormone, believing that it was caused by a toxic element in the extract used. He asserts that toxic doses of the extract must have been used and is unalterably opposed to the use of such extracts in gynecology.

However, Haberlandt<sup>31</sup> specifically stated that there was no evidence of toxic action in his experiments.

#### PERSONAL EXPERIMENTS

In the conduct of my experiments, I have largely followed the line of research laid down by Kostromin and Kartashev, believing that confirmation of their findings would be of great value. I employed female rabbits exclusively, as being the most convenient animal with which to work. It is not too small. On the other hand it is cheap, inexpensive to maintain, and easy to house. It copulates readily when mated. There is never any doubt whether copulation has taken place.

A research worker who is not already familiar with rabbits and contemplates repeating similar experiments, should study carefully the books dealing with the care and breeding of rabbits.<sup>32, 33, 34</sup>

Hygienic housing, proper food, and regularity of feeding are of much importance. Lusk<sup>35</sup> states that in undernutrition in rabbits, the reproductive function is one of the first to suffer. Of recent years it has been fully established that a state of infertility may be produced by a diet deficient in vitamine E. Hammond and Marshall<sup>36</sup> assert that the percentage of rabbits which will copulate depends upon the temperature at the time as well as on the abundance of good

and succulent food. The diet is particularly important in winter time; for poorly nourished rabbits will not breed during cold weather, although they would do so on the same diet during the summer. It is therefore necessary to be liberal with the feeding of the rabbits during the winter and fall in order to avoid a spurious sterility really due to seasonal and dietetic conditions.

The spermatozoa were obtained from various species, rabbits, guinea pigs, and sheep. I was particularly interested in the use of sheep spermatozoa for the reason that, if biologic sterilization should prove a success in woman, sheep testes will be readily applicable to clinical use, since they are easily obtained in large quantities. It would also be desirable to use heterogenous spermatozoa to produce immunity in women, since there would be no danger of shortage of material or of transmitting diseases, such as gonorrhea or tuberculosis, as would be the case if human semen were employed.

The sheep testes were obtained from the slaughter house as soon as the animals were killed. They were kept in their capsules in the ice box until used, usually an interval of about four hours. There was no danger of loss of antigenic power from this delay as testes may be kept as long as seven days without deteriorating, providing the temperature be maintained at from 3 to 5° C. I kept sheep testicles on ice for five days, after which the spermatozoa were still living and active. However, for purposes of injection, I never used material more than four hours old. The low temperature prevents decomposition and growth of bacteria. In the case of rabbit and guinea pig testes, the animals may be killed or castrated whenever their glands are needed. It is best to anesthetize the animal, bleed it to death, and then remove the testes, using the epididymis only. By this procedure the gland is rendered anemic and the danger of nonspecific protein effect reduced to a minimum. When immunizing with living spermatozoa, it is better not to use glands older than two to three days.

The capsules of the testes were opened with sterile seissors and the globus major of the epididymis was removed and placed in a Petri dish with normal saline solution. All visible blood vessels were split open and washed thoroughly to remove more completely the nonspecific proteins. Then the epididymis was placed in another Petri dish with normal saline solution and cut into small pieces the size of a pea. These fragments were stirred thoroughly so as to release the spermatozoa from the gland substance into the saline solution, giving rise to a milky emulsion. After this emulsion was filtered through three layers of gauze and diluted to the desired extent, it was ready for injection.

At first unwashed spermatozoa were used. Later the emulsion was placed in centrifuge tubes and rotated for five minutes. The supernatant fluid was pipetted off and the sediment mixed with fresh saline and recentrifugalized. This procedure was repeated three times. The washed spermatozoa were then examined under the microscope and invariably found to be actively motile. Before injection the spermatozoa were placed in an incubator, the temperature of which was gradually raised to 37.5° C. Thus warmed, even the sluggish spermatozoa regained their active motility. If the chemical reaction was other than faintly alkaline, a strong solution of sodium bicarbonate was added until this reaction was produced.

The proper concentration of the suspension for injection is very important. At first the concentration was estimated by a turbidity comparison test, such as is used for roughly counting the number of microorganisms in bacterial vaccines. As

standards of strength, the emulsions were compared with suspensions containing one to two billion bacteria per cubic centimeter. But this method soon proved too uncertain. The most satisfactory method was found to be by actual count in the Thoma-Zeiss chamber. Since our ultimate object is clinical application, it was felt that the dosage should be determined with great accuracy.

The actual number of spermatozoa contained in 1 c.c. of the packed spermatozoal suspension was found to be about 6,000,000,000. This figure was derived as follows: A 1:1000 suspension of sheep spermatozoa counted in the Thoma-Zeiss chamber gave an average of 600 spermatozoa per square. The square has an area of 1 sq. mm. but a depth of only 1/10 mm. Therefore, the multiplication must be by 10 to make 1 c.mm., by 1000 to make 1 c.c., and by 1000 to correct the dilution:  $600 \times 10 \times 1000 \times 1000 = 6,000,000,000$ .

For purposes of injection a suspension containing 30,000,000 spermatozoa per cubic centimeter was used. Therefore the packed suspension was diluted 1:200. I gave the injections either subcutaneously or intramuscularly, as these will undoubtedly be the routes by which women will receive them, should the method prove of value. Some investigators, including Tushnov, have used the intravenous and intraperitoneal avenues.

While the number of injections, their frequency and the dosage are matters of much importance, it was necessary to be quite arbitrary in these respects, as there are no exact standards to follow. In my experiments I began with a dose of 1 c.c., containing 30,000,000 spermatozoa. The second dose was 2 c.c.; the third, 4 c.c.; and the fourth, 6 c.c. The interval between the injections was two days.

The animals were studied closely and their temperature was taken before and after the injections. There was no noticeable change in their condition or behavior. They ate and behaved just like the control animals and the temperature showed hardly any deviation.

Two or three weeks after the last injection, the immunized animals were placed in a hutch with male rabbits for about one week. This did not prove to be a wise procedure, as the animals do not mate well when kept together and the bucks fight each other. Early in my experiments I lost quite a few animals, particularly males. Although they were much tamer, the does also would fight and several of them were killed in this way. The rabbits were then segregated and the practice of bringing the does to the bucks' hutches followed, the bucks being served with the does at intervals of a few days. This procedure proved far more satisfactory.

The first series of experiments was conducted with unwashed and washed live spermatozoa. Doe rabbits were injected, one set with rabbit spermatozoa, another with sheep spermatozoa, and a third with guinea pig spermatozoa.

For the second series, the same spermatozoa were employed, the only difference being that they were not living but killed by formalin, which not only kills the spermatozoa but also preserves the emulsion and prevents contamination, thus enabling us to stock it up for future use. I found that it is not necessary to use living spermatozoa in order to induce biologic sterility in the female. From the clinical point of view, this is a matter of importance, since the application of injections to women and the preparation of stock solutions would be greatly facilitated if dead spermatozoa could be used as effectively as living ones.

In the preparation of the emulsion of dead spermatozoa the material was centrifuged, and washed three times, just as when living spermatozoa were used. Then an emulsion ten times as strong as would be used for injection was prepared. The spermatozoa were killed with 0.25 per cent formalin; so that, when the material was diluted ten times preparatory to injection, it contained 0.025 per

cent of formalin. This method of preparing the material for injection by diluting a stronger stock solution had two advantages: The stronger formalin solution prevented decomposition and contamination, while the weaker solution proved free from deleterious effects when injected. The injections in the second series were given in the same manner and dosage as in the first.

In the third series only sheep spermatozoa were used. One question which I wished to answer was: Is it necessary to have intact though dead spermatozoa to induce sterility in the female or can the same result be obtained by injecting various substances extracted from spermatozoa?

The integrity of the spermatozoa was destroyed by the following three methods:

1. Sheep spermatozoa were prepared in the same manner as in the first two series. Then 1 c.c. of the packed sediment was rubbed with sterile washed and ignited sea sand in a mortar. Two hundred c.c. of normal saline were added. The mixture was allowed to stand until the sand settled; then the supernatant fluid was poured off. This fluid was passed through a Berkefeld filter.

2. Sheep spermatozoa were triturated with sand as above and 20 c.c. of 95 per cent alcohol added. After thorough mixing, the sand was allowed to settle and the alcoholic solution decanted. From this the alcohol was evaporated by exposure to an electric fan. The remaining sediment was dissolved in normal saline solution and passed through a Berkefeld filter.

3. To 1 c.c. of packed sheep spermatozoa was added 25 c.c. of normal sodium hydroxide solution, which dissolved the spermatozoa so that only small fragments of heads and tails were discernible as faint shadows. This mixture was neutralized with normal hydrochloric acid solution, was diluted to 200 c.c. with normal saline, and was passed through a Berkefeld filter.

These three solutions were placed in sterile containers and kept on ice. Before injection, the required amount of the solution was placed in a thermostat and brought to a temperature of 37.5° C. The dosage and intervals were the same as in the experiments of the first two series.

In all three series, the injections were given either subcutaneously or intramuscularly on the inner surfaces of the thighs, alternating the extremities with each injection. There was not a single severe local reaction or infiltration in any of the groups of experiments.

#### RESULTS OF EXPERIMENTS

In the first series of experiments, it was desired to ascertain whether intramuscular injections of living sheep and guinea pig spermatozoa, either unwashed or washed, can produce sterility in doe rabbits and how long this sterility may be expected to last. The results of this investigation are given in Table I.

In five of the eleven doe rabbits whose histories are enumerated in Table I, a series of four intramuscular injections of sheep or guinea-pig spermatozoa, either unwashed or washed, produced a period of sterility lasting over six and a half months and still existing at the time when this paper was written. These animals were periodically subjected to intercourse with bucks of proved potency and all of the controls became pregnant; therefore, there can be no question but that the sterility was the result of the spermatozoal injections. Unfortunately four of the animals of the first series died before the duration of their sterility was sufficiently long to be of statistical value.



TABLE I. INTRAMUSCULAR INJECTIONS OF LIVING SPERMATOZOA

NO. OF DOE	RABBIT VIRGIN OR MATRON	SPERMATO- ZOA	WASHED OR UNWASHED	COMPUTED DATE OF CONCEPTION	DATE OF GIV- ING BIRTH	NO. OF OFF- SPRING	DAYS OF STERILITY	REMARKS
1	V	G.P.	U	----	----	--	82	Died 9/28/27
2	V	G.P.	U	----	----	--	208	
3	V	G.P.	U	----	----	--	208	
13	M	G.P.	W	----	----	--	208	
15	M	G.P.	W	----	----	--	---	Died 7/ 7/27
4	V	SHP.	U	11/ 3/27	12/ 3/27	4	115	
5	V	SHP.	U	----	----	--	64	Died 9/10/27
6	V	SHP.	U	10/28/27	11/28/27	4	110	
16	M	SHP.	W	----	----	--	86	Died 10/ 2/27
17	M	SHP.	U	9/ 3/27	10/ 3/27	2	57	
18	M	SHP.	W	6/ 9/27	7/ 9/27	1	---	Pregnant when injected

Each cubic centimeter contained 30,000,000 living spermatozoa, either guinea pig or sheep and either unwashed or washed, as indicated in the table.

Dosage: First on July 1, 1927—1 c.c.; second on July 3, 1927—2 c.c.; third on July 6, 1927—4 c.c.; fourth on July 8, 1927—6 c.c.

Doe 18 gave birth to one healthy offspring soon after the injections were completed. She was at the beginning of her second half of pregnancy when the injections were begun and it is noteworthy that the injections did not produce abortion, although the possibility arises that they may have been in some way instrumental in preventing a larger litter. In Doe 17 the period of sterility of fifty-seven days is too brief to be considered a successful result. It is interesting that the four pregnancies occurring in this series gave increased litters as the period of sterility was prolonged. The remaining does are still sterile, a period of nearly seven months.

An immunity lasting seven months may not seem significant, unless we consider the relatively short life of the rabbit as compared with the human being. The life of a rabbit is about eight years, and its usefulness as a breeder about four years. Seven months of sterility in a rabbit is therefore equivalent to approximately three years and eleven months in a woman, an appreciable interval of time. It would seem well within the limits of probability that, should biologic sterility prove possible in woman, it will last sufficiently long after the injections to make it of practical value. This state of affairs would apply particularly to such illnesses as tuberculosis, in which a delay of child-birth for several years may be the means of enabling the patient to have a healthy child with relative safety.

In the second series of experiments my aim was to discover whether there is any marked difference when spermatozoa killed with formalin are used instead of the living and active cells. As will be noted in Table II, there were no failures in this series.

The purpose of the third series of experiments was to ascertain whether spermatozoa which were not only dead but whose morpho-

TABLE II. INTRAMUSCULAR INJECTIONS OF WASHED SPERMATOOZOA KILLED WITH FORMALIN

NO. OF DOE	RABBIT	VIRGIN OR MATEON	SPERMATO- ZOA— WASHED	NO. OF IN- JECTIONS	INJECTIONS COMPLETED	COMPUTED DATE OF CONCEPTION	DATE OF GIV- ING BIRTH	NO. OF OFF- SPRING	DAYS OF STERILITY	REMARKS
33	V	G.P.	4	7/27	----	----	----	---	---	Died 7/31
34	V	G.P.	4	7/27	11/	3/27	12/ 3/27	3	97	
35	V	G.P.	4	7/27	----	----	----	---	190	
36	V	SHP.	4	7/27	----	----	----	---	---	Died 8/10
37	V	SHP.	6	9/28	----	----	----	---	190	
38	V	SHP.	6	9/28	12/28/27		1/28/28	5	151	
39	M	SHP.	4	7/29	----	----	----	---	---	Died 8/ 8
40	M	SHP.	4	7/29	----	----	----	---	188	
41	M	SHP.	6	9/28	----	----	----	---	188	
42	M	RAB.	4	7/29	----	----	----	---	188	
43	M	RAB.	4	7/29	----	----	----	---	118	Died 11/27
44	M	RAB.	4	7/29	----	----	----	---	188	

Each cubic centimeter of the material injected contained 30,000,000 spermatozoa killed with formalin, derived either from guinea pig, sheep, or rabbit. The first injection consisted of 1 c.c.; the second, 2 c.c.; the third, 4 c.c.; and the fourth, fifth and sixth, 6 c.c.

logic integrity had been destroyed as well were capable of inducing sterility on parenteral injection. The four does injected with spermatozoa extracted with alcohol showed a sterility of from one and a half to two months and then gave birth to practically normal litters. The four does injected with spermatozoa extracted with sodium chloride showed a sterility lasting from two and a half to three months and then gave birth to litters decreased in number. The four does injected with spermatozoa extracted with sodium hydroxide showed a sterility lasting to the present, over four months. From these results it may be concluded that injections of spermatozoa extracted with alcohol and spermatozoa extracted with sodium chloride tend to decrease the number in the litters and the short period of sterility is probably due to a nonspecific protein action as Köhler<sup>20</sup> has suggested in explanation of Haberlandt's results. Injections of spermatozoa extracted with sodium hydroxide have thus far proved to be effectual. As the spermatozoa employed in the third series of experiments were morphologically destroyed and probably also considerably altered in their chemical construction, it is difficult to attribute their action entirely to true antigenic power.

All of the fifteen control does, coming from the same stock and living under exactly the same conditions as the immunized animals and copulating with the same bucks, became pregnant within a month.

#### SPERMATOXICITY OF THE SERUM

Tests were employed to determine the spermatoxicity of the serum of the immunized does, the control does and also the bucks. Several methods are available for making this test. I employed the simplest, that used by Tushnov. In this test one drop of fresh standardized

emulsion of actively motile spermatozoa is mixed with two drops of the serum to be tested and placed on a hanging drop slide under the microscope.

The blood is obtained from the rabbit's ear either by puncturing a vein and collecting the drops as they form in a test tube or by aspirating it from one of the veins of the ear by means of a hypodermic syringe. As a rule, about 1 c.c. of blood should be withdrawn. It should be put into a narrow test tube, kept in a thermostat, and there allowed to clot. The serum is then pipetted off and centrifuged.

When the hanging drop slide is placed under the microscope, the observer watches for the time when the activity of the spermatozoa begins to be retarded and when it is completely arrested. As the spermatozoa become less motile, they form clumps, gathering with their heads stuck together and their tails extending outward. The length of time required before agglutination takes place varies and does not seem to follow any special rule. There is no apparent change in the morphology of the spermatozoa to account for the loss of motility.

It is difficult to determine the exact time at which motility of the spermatozoa ceases. The approximate length of time required for the serum to inhibit the motility of the spermatozoa was from four to twenty-five minutes. In the case of the serum of one buck, it was a full hour.

TABLE III. SPERMATOXICITY AGAINST VARIOUS SPERMATOZOA

Evidence of spermatox. city in immunized animals	6 to 23 min.
Evidence of spermatox. city in control animals	5 to 32 min.
Evidence of spermatox. city in bucks	15 to 60 min.

Spermatox. city of vaginal secretion was equally inconstant.

A glance at Table III will show that the results of the spermatox. city tests do not help us in understanding the nature of the biologic immunity induced by injections of spermatozoa. The average spermatox. city of the immunized animals did not differ considerably from that of the controls. Only the bucks showed any appreciable difference in this respect, their serum being considerably less spermatox. city than that of all the does, immunized and nonimmunized alike.

The results of my spermatox. city tests support the work of Bodnar and Kamniker,<sup>20</sup> who, after studying the viability of spermatozoa in the blood sera of one hundred women, were unable to find any consistent relationship between the existence of sterility and the spermatox. city of the serum.

The spermatox. city of the vaginal secretion in the controls and in the immunized animals before and after the injections was also studied. A loopful of the secretion from the vagina was mixed with two loopfuls of standardized sheep or guinea-pig spermatozoa and examined on a hanging drop slide under the microscope. On the average, it took thirty minutes before the spermatozoa ceased moving in the drop of vaginal secretion. The spermatox. city of the vaginal secretion in the

various immunized does proved to be so inconstant that no definite conclusion could be reached as to its significance.

*A priori* one would expect to find the vaginal secretion of immunized rabbits spermatoxic. Djershevsky<sup>37</sup> has shown that the uterine secretions of mares immunized against diphtheria contain antitoxin. Furthermore, in McCartney's<sup>16</sup> experiments on rats, sterility seemed to be due to the presence of spermatoxins in the uterine and vaginal secretion of the immunized animals, since these secretions agglutinated spermatozoa. Tushnov,<sup>11</sup> on the other hand, does not believe that immunity is due to spermatoxicity of the uterine contents, as he did not find the mucus of the uterine cavity spermatoxic. He attributes the immunity to a disturbance of the biochemical relationships of the generative elements.

#### WHAT CAUSES BIOLOGIC STERILITY?

In the present state of our knowledge, it is impossible to state what causes biologic sterility after immunization with seminal products or ovarian transplants or extracts.

The first possible explanation is that immunization inhibits ovulation. Opposed to this view is the fact that the immunized animal's sexual life is in no way disturbed, except for the sterility. It generally accepts service from the male and goes through the normal sexual epochs. Furthermore, Dittler<sup>14</sup> performed repeated laparotomies upon animals rendered sterile by semen injections and found the process of ovulation to be progressing normally. We can therefore eliminate inhibition of ovulation as the reason for biologic sterility.

Do the semen injections produce degenerative changes in the ovary? Ovaries of various animals have been subjected to careful examination after this method of immunization and no histologic changes have been found as a result of the treatment.

The spermatoxicity of the serum would appear to offer a likely explanation, particularly in view of the fact that rabbits have been proved to elaborate specific precipitins in their blood after injections of semen. However, this subject has been carefully studied and no consistent relationship can be found between the duration of the sterility biologically induced and the strength of the spermatoxicity. In fact, in my experiments I was unable to show that the serum of immunized rabbits is more spermatoxic than that of controls. Bodnar and Kamniker<sup>20</sup> also observed this lack of definite relationship in women suffering from sterility and in virgins.

The most likely explanation is that offered by McCartney,<sup>16</sup> who found active spermatoxicity of the uterine and vaginal secretions in immunized rats. He believes that the spermatoxins act in the genital tract by killing the spermatozoa introduced by normal coitus and thus preventing impregnation. Tushnov,<sup>11</sup> however, could observe no sper-

matotoxicity of the vaginal secretions of rabbits; the results were too variable to have any significance.

Until more evidence is brought forth, it is impossible to reach a conclusion as to the cause of sterility biologically induced.

#### SUMMARY

Artificial production of sterility is a subject of much importance to the physician who is called upon to advise married women who are physically unfit to bear children. Under such circumstances, there is general agreement that the patient should be instructed with regard to contraceptive technic or, if pregnancy should ensue, that a therapeutic abortion should be induced.

The mechanical means of contraception generally practiced are decidedly inconvenient and, to a certain extent, unreliable, and none of them permits anything like normal sexual relations. While they do not cause serious disturbances of the genital organs, the lack of full consummation cannot but be harmful to the nervous system.

Surgically induced sterility, too, is subject to decided disadvantages. With most operations, the condition of sterility is permanent. Although remediable sterility may be induced by the operations described by Sellheim<sup>4</sup> and Turenne,<sup>3</sup> respectively, these procedures involve two laparotomies on a woman who presumably is too sick to bear children.

Although still in the experimental stage, biologic immunization of the female organism to seminal products offers great promise of clinical application as a means of inducing temporary sterility. Should this method prove successful in human subjects, it will possess obvious advantages. It will enable many women suffering from temporary incapacity to postpone childbirth until such time as they may be physically fit for this function. And, since the equipment will be entirely in the hands of physicians, it can be used only for *therapeutic* purposes.

The most promising method by which artificial biologic sterility may be produced in animals is by the injection of spermatozoa derived from the same or another species. Numerous independent investigators have obtained positive results in experiments on this subject. In my own experiments, rabbits immunized by injections of sheep or guinea-pig spermatozoa are still sterile after nearly seven months. The most effective results would, of course, be expected from the injection of living and active spermatozoa; but I also used spermatozoa killed by formalin and also spermatozoa morphologically destroyed and probably likewise chemically altered by three different processes. The rabbits injected with dead spermatozoa are still sterile after nearly six and a half months.

Sterility has also been induced by Haberlandt and other workers by transplanting the ovaries of pregnant animals of the same species

and also by the injection of ovarian extracts. This, too, is a subject calling for further investigation and offering clinical possibilities.

The mechanism by which biologic sterility is produced is unknown. When the temporary period of sterility has passed, the animal is again able to bear healthy young. It has been fully established that the ovaries are not damaged and the process of ovulation is not disturbed by the artificial induction of biologic immunity. With regard to spermatoxic properties induced in the serum by the spermatozoal injections, I found no consistent differences between the sera of the immunized and the control does, respectively. Other investigators, likewise, have been unable to demonstrate any definite relationship between the spermatoxicity of the serum and the duration of sterility biologically induced. It has been suggested that the injection of spermatozoa is followed by the appearance of spermatoxic substances in the vaginal secretions, which either destroy the spermatozoa introduced at copulation or inhibit their motility. While I was unable to find evidence of spermatoxic substances in the vaginal secretions of the rabbits which I immunized to spermatozoa, I admit the possibility of this hypothesis.

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# LEIOMYOSARCOMA OF THE UTERUS

## REPORT OF A CASE, WITH A BRIEF REVIEW OF THE LITERATURE

BY EARL C. SAGE, M.D., F.A.C.S., AND A. J. MILLER, M.D., OMAHA, NEB.

MRS. M. T., colored, referred to me by Dr. J. B. Hill of Omaha, entered the Methodist Hospital, December 20, 1927, complaining of an abdominal enlargement, severe and constant abdominal pain, especially in the lower abdomen; foul bloody watery vaginal discharge; shortness of breath; and a fever of 101° to 103°. Patient was said to be about forty-six years of age, but she did not know when she was born, and appeared to be fifty-five to sixty years of age.

More than ten years ago, patient first noticed the abdominal enlargement, which has gradually increased in size. During the past two years, she has had more soreness and pain in both lower quadrants of her abdomen, and almost a continuous profuse, foul-smelling, bloody or watery vaginal discharge.

During the past year, there has been no regular menstrual flow, and the patient does not know when she had the menopause.

During the past three or four months, she has been frequently nauseated and has vomited at times. The pain in the lower part of the abdomen has increased in severity and has been present most of the time. Patient has been married three times and was never pregnant.

*Physical Examination.*—Patient is sitting up in bed to relieve pain in her back, looks ill, has some difficulty in breathing. Temperature at present 96.6°, pulse 84, blood pressure 130/74. Positive findings in physical examination.

*Head.*—Gray hair around temples; pterygium on both eyes; upper teeth false; many teeth missing in lower jaw.

*Chest.*—There is an area of impaired resonance at the angle of the right scapula, where the breath sounds are less distinct and where moist râles are heard. Heart is not enlarged, but a systolic murmur is heard at the apex of the heart.

*Abdomen.*—The size and shape of the abdomen are similar to a patient with a full-term pregnancy. A hard mass is felt extending from the pelvis to the costal borders, with tenderness elicited over the entire lower abdomen. Hard, irregular nodules can be palpated through the rather thin abdominal wall, and the whole mass is somewhat irregular in outline.

*Vaginal Examination.*—A foul-smelling, purulent, serosanguinous discharge is seen at the introitus. When the examining fingers reach the cervix, it is found to be effaced and dilated as you would expect in a patient who was in labor. Through this dilated cervix can be felt soft, mushy, necrotic pieces of tissue, which can be brought out through the cervix with the fingers. Some of this material was saved for section and microscopic study.

*Laboratory Findings.*—R.B.C. 4,180,000, W.B.C. 10,300. Hb. 75 per cent. Differential 84 polys., 16 lymphocytes. Wassermann 2-plus.

*Preoperative Diagnosis.*—Fibromyoma of the uterus with malignant degeneration and suppuration; bronchitis.

*X-ray Examination of Lungs.*—Fluoroscopic examination of thorax revealed very diminished excursion of diaphragm on both sides. The costophrenic angles were clear. Apices aerated on coughing. Increase in hilum shadows on both right and left sides, with more on the right. The cardiac shadow was normal.

Stereoscopic films corroborated the fluoroscopic findings. There was considerable increased density of the hilum on both sides, conforming more or less to the

ramifications of the bronchovascular tree at the root of the lung. There was no evidence of parenchymal involvement at the present time, which could account for her elevation in temperature.

Dr. C. B. Peirce, roentgenologist, was inclined to regard the hilum shadows as suspicious, until proved otherwise, rather than a suggestion of malignancy. They could be due, of course, to old tuberculous infection. There was not visible at this time, any evidence of parenchymal metastases.

Even though the patient was a poor operative risk, since her condition was not compatible with life, an operation was planned. The patient was running a septic temperature, as Fig. 1 will show, she had the characteristic metrorrhagia and watery discharge for two years, she was in constant pain, and decided to take the risk.

The patient was operated upon January 5, 1928, a midline incision was made from the symphysis to one inch above the umbilicus. There were some adhesions to the fundus and posterior wall of the uterus, extending to adjacent coils of small intestine. After freeing these a complete hysterectomy was performed. The malignant growth had evidently extended into the broad ligaments and pelvic walls as myxomatous tissue was cut through in freeing the uterine tumor mass.

The patient exhibited signs of shock as the tumor was removed, normal saline was administered under the breasts and caffein sodium benzoate given hypodermatically.

After the peritoneum was sutured, the other layers of the abdominal wall were quickly closed with interrupted silkworm-gut sutures.

The patient made an uneventful postoperative recovery; there was primary union of the wound and her temperature dropped to normal on the third postoperative day. She was out of bed on her fifteenth postoperative day, and walking around the ward at the end of three weeks.

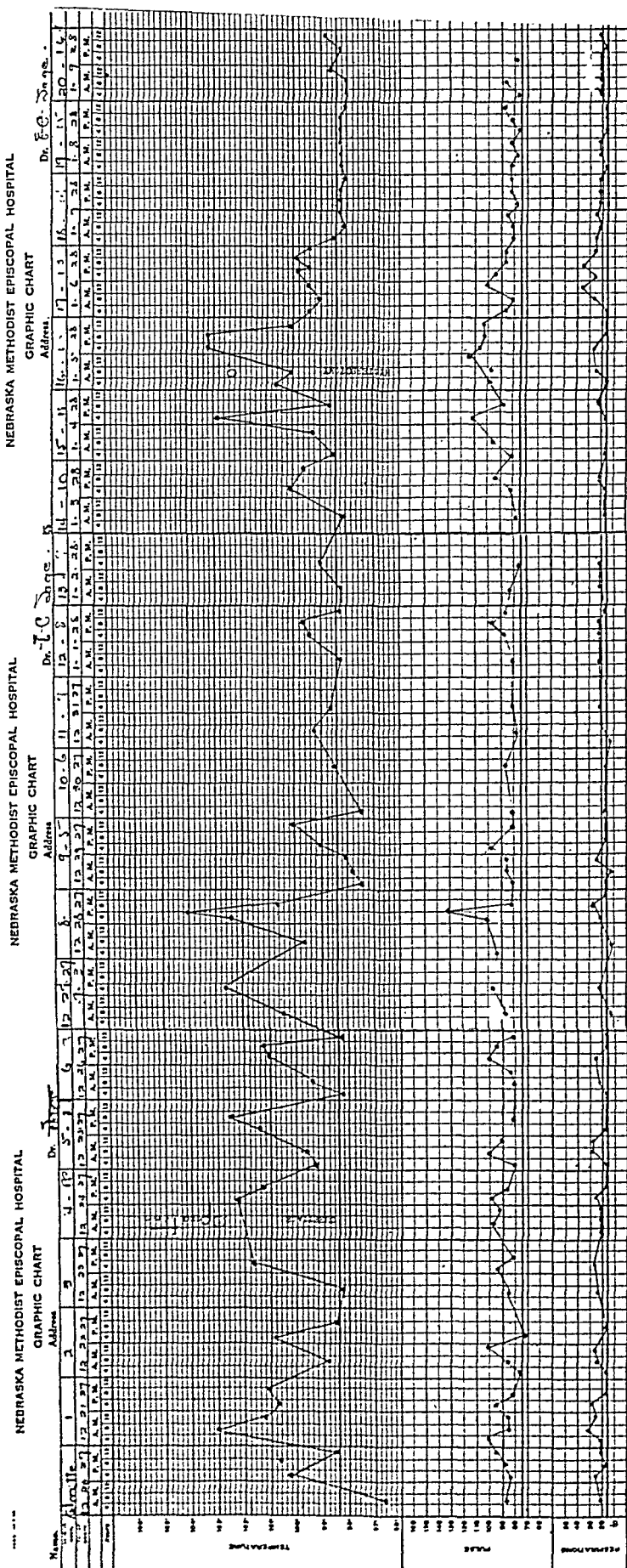
She has some swelling of the axillary glands on the left side, and her left arm became swollen on the eighteenth postoperative day, and another x-ray examination of her lungs was ordered to ascertain whether metastases could be shown. X-ray examination of lungs on the nineteenth postoperative day showed the following.

#### X-RAY REPORT

Fluoroscopic examination of the thorax revealed a good excursion of the diaphragm. Costo-phrenic angles clear. Heart shadow within normal limits. The hilum is increased on both sides with a suggestion of round masses of increased density in the hilum and one or two in the outer lung fields, particularly on the right side.

Stereoscopic films of the thorax demonstrate a fairly symmetrical thoracic cage. Domes of the diaphragm are smooth. Costo-phrenic angles are clear. Cardiac shadow normal. Hilum shadows increased on both sides with soft increased markings of the broncho-vascular tree, particularly on the right side, but somewhat to the left. In the





hilum there is suggestion on the right side of some round masses very similar to those previously observed. Some thickening of the apical pleura, particularly on the left with slight irregularity of its shadow. Beneath the inferior angle of the right scapula there is observed a round area of increased density quite soft in character, apparently lying in the outer lung field which would suggest from its contour and density, a neoplastic growth. I do not find any other areas which are so peculiarly suggestive. I still do not feel that we can say absolutely that there is a pulmonary neoplastic metastasis.



Fig. 2.—Gross specimen. Nodular uterus measuring 16 by 18 by 20 cm. with adnexa attached. Cervix was dilated two fingers. Necrotic mass shown just above cervix.

#### METASTASES

In this connection, it is interesting to note that Ewing has only encountered three malignant uterine myomas with general metastasis and two with local recurrence in twenty years, and Winter found no case among 753, so that malignant degeneration of myoma must be rare.

However, a rather numerous group of cases of leiomyoma are on record, which have proved malignant, breaking the natural boundaries and producing metastases in liver, lungs, kidney, peritoneum, and lymph nodes, and thereby acquire the designation "myoma malignum."

In Evans' series of 72 malignant fibromyomas in a series of 4000 operations for uterine fibromyomas at the Mayo Clinic, definite indica-

tions of metastases to distant organs were not found in any of these cases. From the findings at operation and from the subsequent histories of the fatal cases there was evidence of extensive and local abdominal metastases. He states "As compared with other types of malignant tumors, nonepithelial uterine tumors are said to be comparatively low grade in malignancy. This seems to be true in so far as metastases in distant organs are concerned. But from the standpoint of rapid and extensive local infiltration, these tumors must be classified as extremely malignant.

The report of the study of the tumor mass is as follows:

*Gross Examination* (Fig. 2).—The specimen consists of a symmetrically enlarged but somewhat nodular uterus measuring 16 by 18 by



Fig. 3.—Specimen of uterus cut in half, showing the malignant degeneration occupying practically the entire uterus. On section the lumen is filled with foul-smelling necrotic greenish yellow tags of tissue, which on section proved to be leiomyosarcoma.

20 cm. with the adnexa attached. On section the lumen is filled with foul-smelling, necrotic, greenish yellow tags of tissue. The tumor weighs 5½ pounds. The necrotic area measures about 15 cm. in length and 7 cm. in width. From the picture of the cross-section, it is seen that the degenerated area occupies a large portion of the fibroid tumor. (Fig. 3.)

*Pathologic Examination, Dr. A. J. Miller.*—The sections are made of uterine wall; the inner portion of which is replaced by neoplastic tissue. This is made up of long spindle cells with eosin staining cytoplasm, shaped much like normal muscle fibers. In portions, however, these cells are polygonal but they still have eosin staining cytoplasm.

The nuclei of the elongated cells are also elongated and resemble greatly the nuclei of muscle cells, except that they are larger and have more chromatin material. The nuclei of the polygonal cells are very irregular but they tend to be round. Chromatin material varies much in its arrangement and density. Mitotic figures are abundant in these cells and are occasionally found in the spindle cells. There are quite a number of giant cells. There are a number of atypical mitoses, consisting of irregular or multipolar spindles. There is in different sections a rather imperfect gradation between the cells which very definitely resemble uterine muscle and the large polygonal cells which resemble surface cells more than muscle.



Fig. 4.—Photomicrograph of spindle cell tumor tissue resembling myometrium invading the wall of the uterus. (Low power.)

The first impression of these polygonal cells was that they were possibly epithelial derivatives or syncytial masses. This view was no doubt in error. The malignant nature of the neoplasm is definitely demonstrated at the periphery where the new growth is destroying the muscle tissue and also in several places, has invaded blood vessels.

Sections were submitted to Dr. F. B. Mallory, Boston City Hospital, who replied, "Your tumor is unquestionably a very pretty leiomyosarcoma."

Sections were also submitted to Dr. S. B. Wolbach at Harvard Medical School who replied, "For awhile I wondered whether possibly you had something in the way of a mixed tumor with striated muscle ele-

ments suggested by the large cells, but I could find no proof of this, and I do not regard the cells as incompatible with smooth muscle tumor. I think you are dealing with a very rapidly growing malignant leiomyoma or leiomyosarcoma." (See Figs. 4, 5, 6, 7, 8, and 9.)

There are two views as to the origin of this tumor: One that it is a leiomyosarcoma, or smooth muscle tumor which has been malignant from the start; the other that it is a malignant leiomyoma, or a "fibroid" that has become malignant. The latter view is the most commonly accepted.

According to MacCallum, malignant tumors spring out of benign myomas which have already existed for a long time, but the question

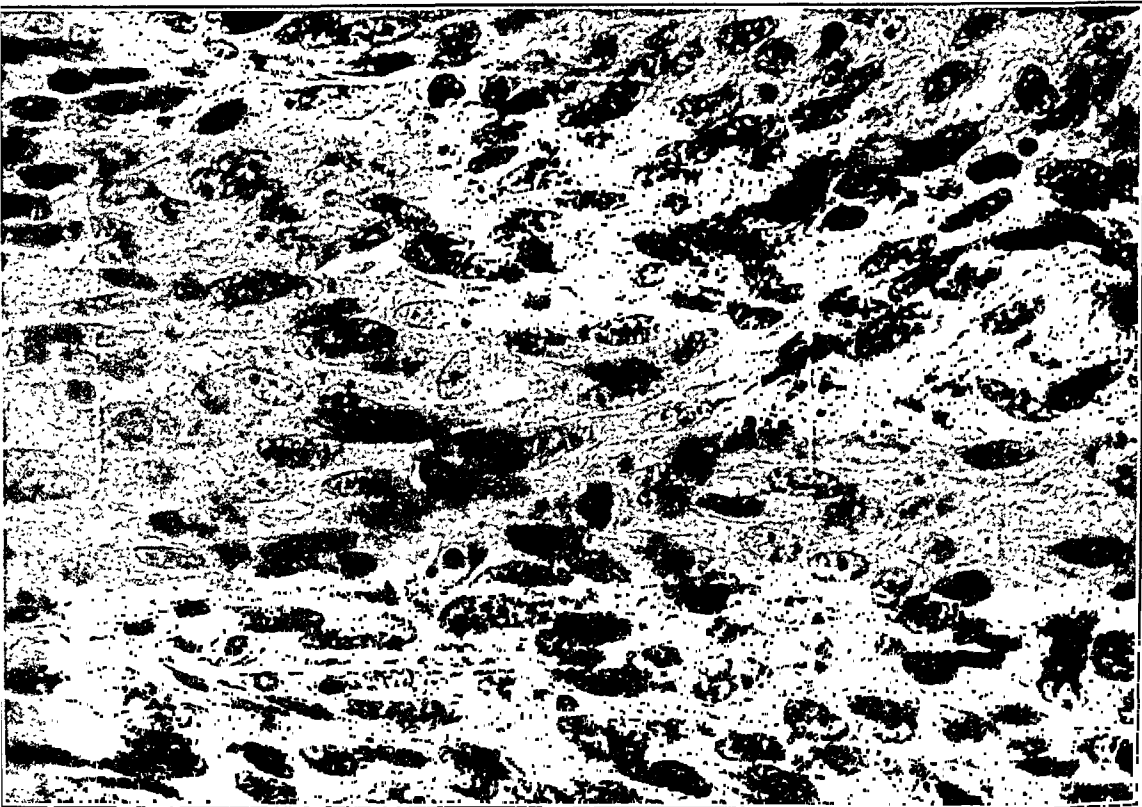


Fig. 5.—Photomicrograph of the spindle cell tumor tissue shown in Fig. 4. The cells are all similar in type, have eosin staining cytoplasm similar in shape and staining reaction to the plane muscle in the uterus. In this portion of the tumor there is but one type of cell. One mitotic figure is shown near the center of the field. (High power.)

remains as to their exact origin. They may be due to the acquisition of malignant powers of growth by the smooth muscle cells, in which case we should speak of them as malignant myomas, or the invasive tumor may be the offspring of the stroma of the myomas, and then it would be justifiable to call the tumor a sarcoma. It is only in the latter case, in which there is a true sarcoma mixed with muscle tissue of the myoma, that such a term as myosarcoma is justifiable. A sarcoma is not a tumor derived from muscle, but rather one arising from connective tissue.

*Further History.*—On February 18, 1928, I was notified that the patient died at her home forty-five days after the operation. After receiving the pathologic reports, we told the family that we did not feel the patient could live over two months. The exact cause of death could not be ascertained, as autopsy was not permitted, so the extent of the metastases will never be known.

TABLE I. FREQUENCY OF NONEPITHELIAL MALIGNANT UTERINE TUMORS AS COMPARED WITH FREQUENCY OF FIBROIDS (FROM EVANS)

	FIBROIDS	MALIGNANT	PERCENTAGE	
Proper and Simpson	357	22	6.00	
Miller	9750		1.96	
Lewis	1518		1.40	
Olshausen	6470		1.30	
Kelly and Noble	2274		2.00	
Winter	500		3.20	
Winter	253		4.30	
Noble	337	2	0.60	
Kelly and Cullen	1400	17	1.20	
Martin	205	4	1.90	
Fehling	109	8	1.90	
Broun, Woman's Hosp., New York	1500	7	0.40	
Warner	100			
Including all "cellular"		7	7.00	
"Sacroma" only		2	2.00	
Geist	250	12	4.80	
Series at Mayo Clinic	968	Group 1	6	0.62
1917 to 1918		Groups 1 and 2	12	1.25
		Groups 1, 2, and 3	38	4.00
1906 to 1918	3297	Group 1	13	0.39
		Groups 1 and 2	22	0.67
Winter, Henkel, Hof- meier, and Flautau	1880	46	2.5	sarcomatous
Cullen	1200	17	1.4	sarcomatous
Bland-Sutton	500	8	1.6	
Lockyer	210	2	0.9	
Blank	188	2	2.1	

TABLE II. FREQUENCY OF EPITHELIAL MALIGNANT TUMORS AS COMPARED WITH FREQUENCY OF FIBROIDS

	FIBROIDS	MALIGNANT	PERCENTAGE
Bland-Sutton	500	8	1.6
Kelly and Cullen	1000	18	0.9
Blank	188	4	2.1

As Evans points out, the frequency of mitotic figures forms the only safe histologic criterion on which to base a diagnosis of malignancy or "near" malignancy.

Incidence of malignancy of the Mayo series of 1.8 per cent.

In some of the numerous collected series of cases of uterine fibromyomas, the relative proportion which shows malignant change is given as low as 0.4 per cent; in others it is as high as 10 per cent.

Maroney states that the diagnosis "must be a matter of individual interpretation in suspicious cases." Evans' article attempts to make such comparisons of the histologic findings and the clinical histories of the 4000 cases available as will serve to contribute something to the establishment of microscopic criteria, in

view of the evident lack of knowledge and lack of acceptance of uniform standards of malignancy as well as degrees of malignancy in this class of tumors.

A composite picture of the characteristics, as has been presented in the writings of several authorities, includes the following points:

1. Increase in size of tumor cells, as compared with normal muscle or benign muscle tumor cells.
2. Shorter and plumper cells with nuclei more nearly oval than normal muscle or benign muscle tumor cells, rounded, and "vesicular" nuclei.
3. Inequality in size and irregularity in shape and arrangement of the cells.
4. Lack of "differentiation" of cells.
5. Unequal staining of nuclei, and deeply staining nuclei.
6. Presence of immense cells (protoplasmic plaques) with hyperchromatic, single, or multiple nuclei (giant cells).

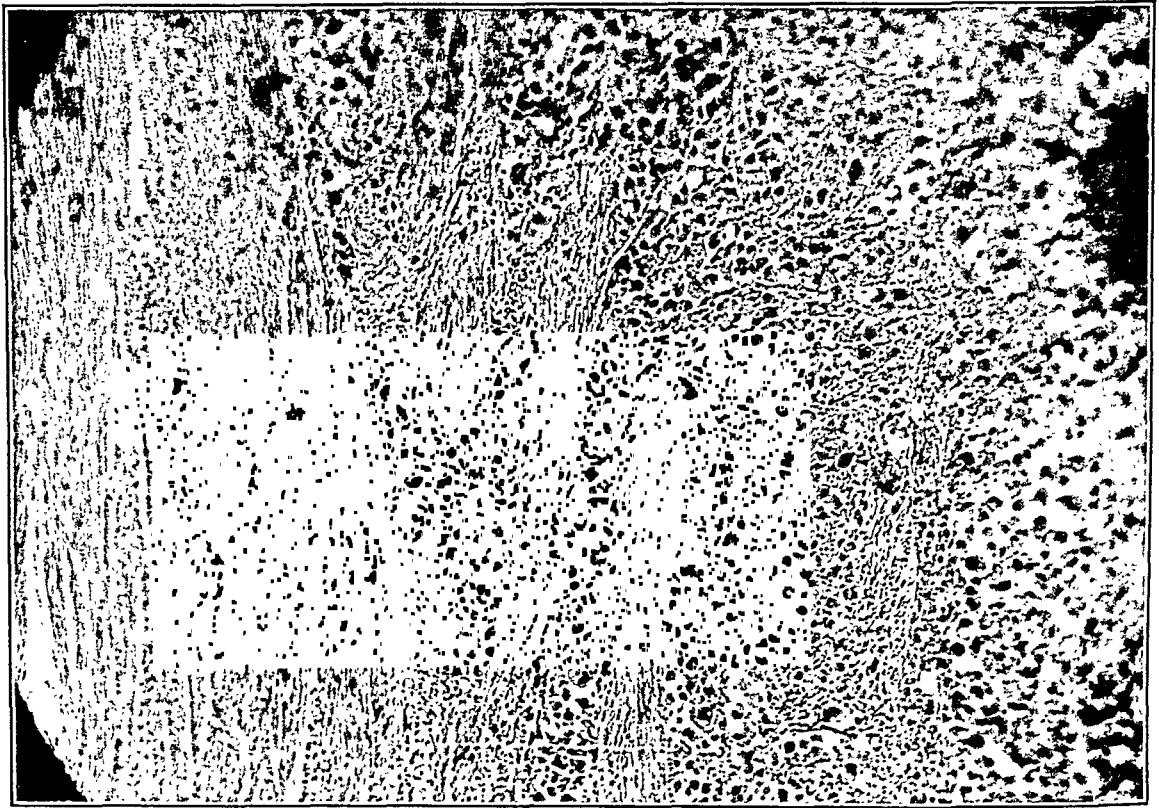


Fig. 6.—Photomicrograph of a different portion of the tumor showing it to be a different type. Large irregular polygonal cells are invading the wall of the uterus. Near the center of the field one invading blood vessel is shown. There are many bizarre cells and mitotic figures. (Low power.)

7. Presence of mitotic figures, typical and atypical.
8. Decrease or absence of stroma fibers between the cells.
9. Thinness or absence of vessel walls.

Proper and Simpson, of the New York State Cancer Laboratory, in their article on "Malignant Leiomyomata" say in substance that the presence of the large irregular nuclei and giant cells is in direct proportion to the degree of malignancy and is an important accompaniment of the malignant process. In doubtful cases they depend on the absence of mitotic figures as the criterion of a benign tumor.

Mallory believes that the presence of mitotic figures in these myomas is a definite indication that they are capable of infiltration and are, therefore, malignant. Lockyer in his volume on fibroids, says that malignant myomas are often difficult

to distinguish and emphasizes the tendency to infiltrate and the presence of mitotic figures as a distinguishing characteristic.

The most important microscopic features aside from the frequency of mitoses are according to Evans:

1. The large size of the great mass of the tumor cells in the given case, and a marked inequality in their size. In those very malignant tumors which are characterized by this type of cellular structure, many abnormally large mitotic figures are apparently invariably found.
2. The relative decrease in the amount of fibrous stroma.
3. The growth among the tumor cells of blood vessels with very thin walls or with walls entirely wanting.
4. The relative increase in the size of the nucleus of the tumor cells as compared with the mass of the cytoplasm of the cell body.

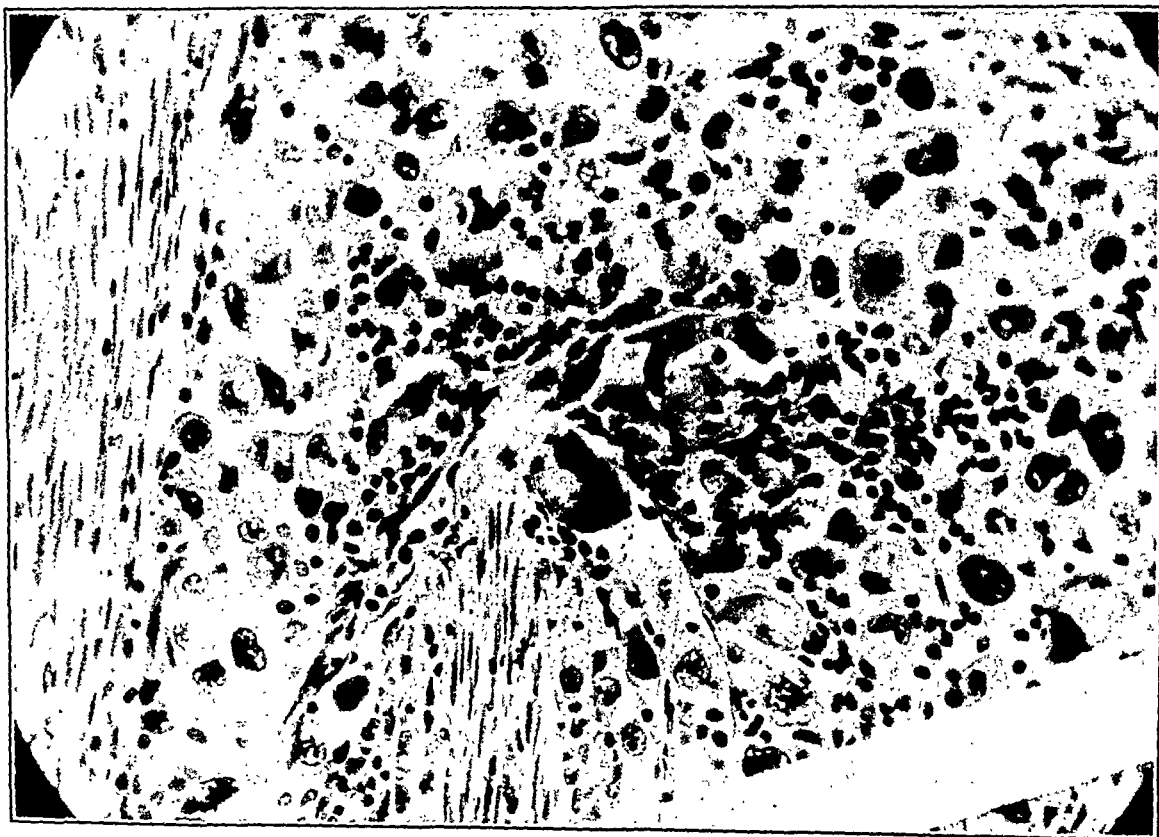


Fig. 7.—Photomicrograph of the same field as Fig. 6 showing the thin-walled blood vessels with several tumor cells in its lumen. (High power.)

While all these changes are important, careful study shows that none is constant, that is, invariably present in the very malignant tumors and always absent in those not malignant. Notwithstanding this fact, it is well to note that the tumors composed of a mass of closely packed cells of very large size are invariably extremely malignant, although it is not true that all the malignant tumors have this particular morphology.

There is evident need of the establishment and recognition of histologic standards of malignancy in the classification of the nonepithelial uterine tumors.



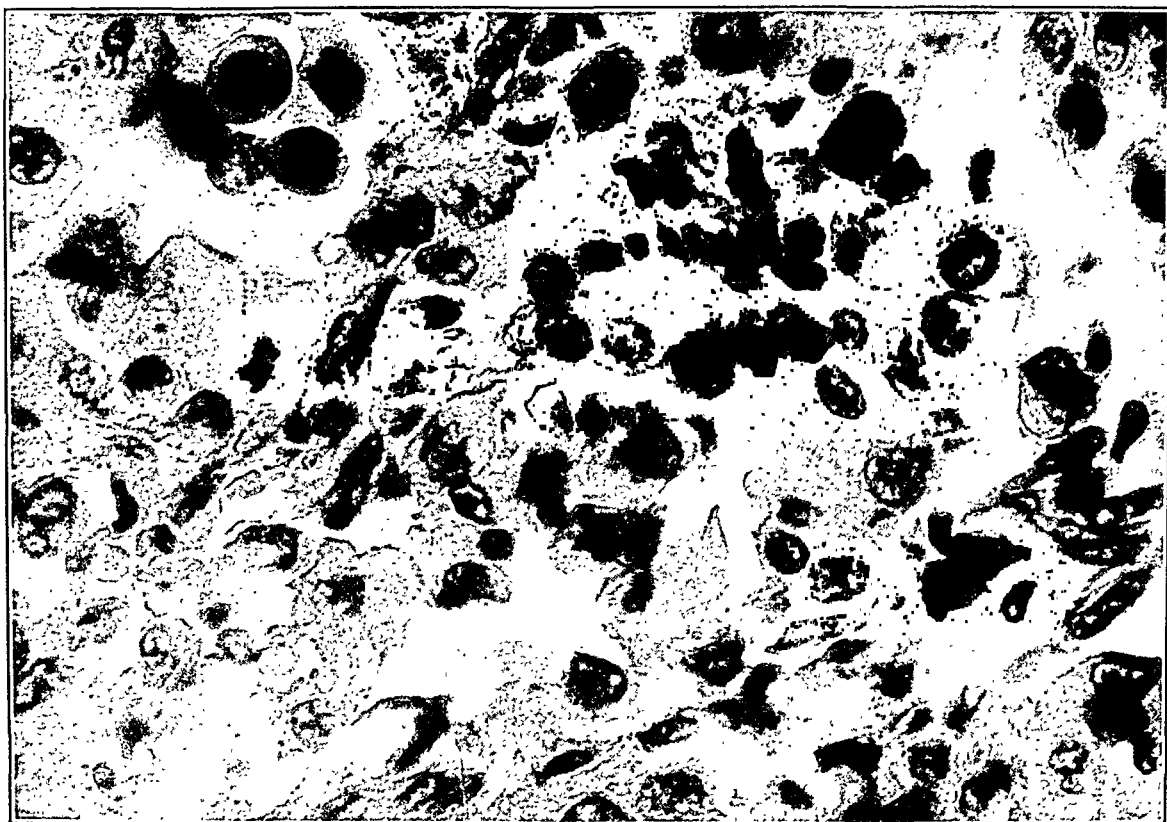


Fig. 8.—Photomicrograph of the central portion of the tumor showing the type of cell to be similar to that in Figs. 6 and 7 but different from that in Figs. 4 and 5. Here the cells are flat, polygonal, have a small amount of new connective tissue stroma, and show no tendency to form the spindle shaped cells. Near the center of the field is a mitotic figure in which the spindle is imperfectly shown. (Low power.)

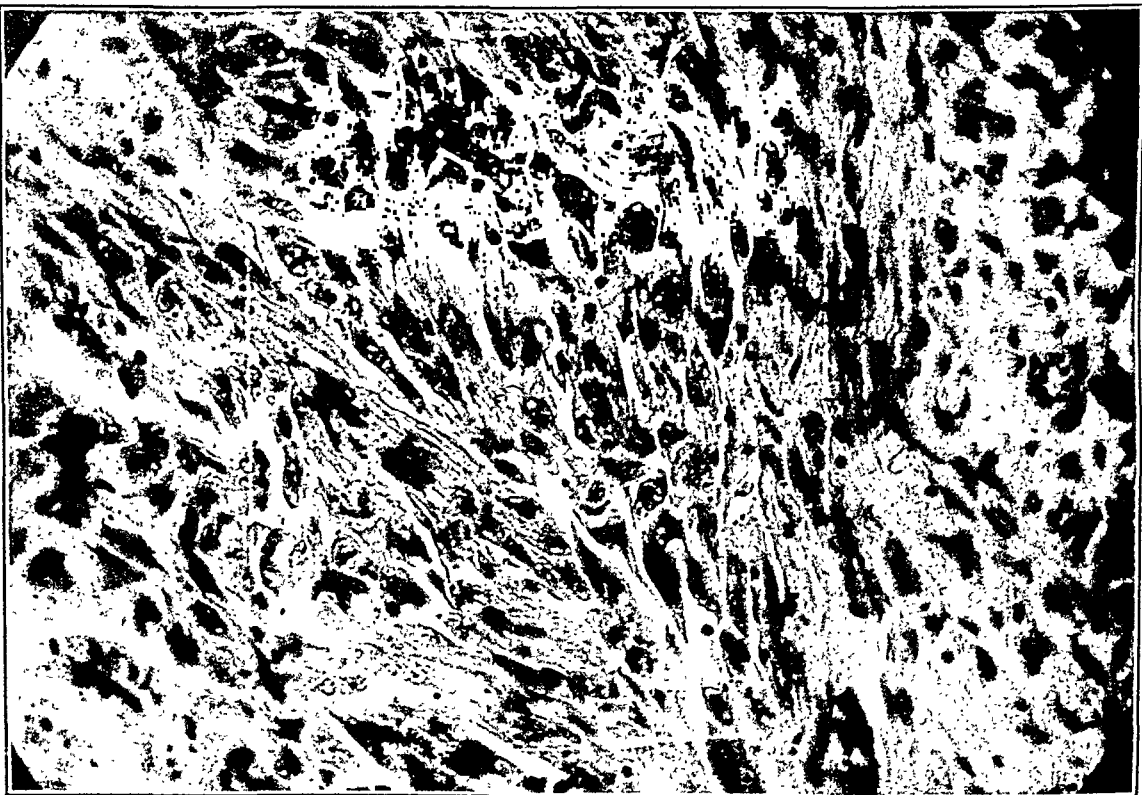


Fig. 9.—Photomicrograph of a different portion of the tumor showing both types of cells in one field. Large irregular polygonal cells are intermingled with spindle-shaped cells which are definitely muscle derivatives. This picture is taken mid-way between portions of the tumor that was composed of spindle cells only and other portions of flat polygonal cells only. There was definite gradation between the two. (Low power.)

In the present study the only single constant microscopic evidence of definite malignancy is the invasion of normal tissue. There are also many atypical cells and abnormal mytoses.

Many of these tumors have numerous large giant cells with multiple hyperchromatic nuclei which are often looked on as evidence of malignancy, but they do not contain mitotic figures. There is no evidence that such tumors are malignant.

In the less malignant tumors not containing numerous mitotic figures there are morphologic evidences of division of tumor cells by direct cell division.

Clinically the majority of patients with definitely malignant tumors present themselves for treatment about the climacteric or later. The tumors are difficult to distinguish in the earlier stages from ordinary fibromyomas; they are not cured by x-ray or radium, and the surgical removal of all fibroids of any appreciable size seems to be the best treatment.

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## CHOLECYSTOGRAPHIC STUDIES IN PREGNANCY

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RADIOGRAPHIC studies of the gall bladder in the human subject, following the intravenous injection of the halogenated phenolphthaleins after the method of Graham and Cole, have stimulated a renewed interest in the pathogenesis of cholecystitis and cholelithiasis. For an extremely long time pregnancy has been considered as a contributing etiologic factor in the production of gall bladder disease. We were impressed with the idea that this method of examining the gall tract might disclose the occurrence of functional alterations in the course of pregnancy. If such were found, we believed that they might perhaps lead to more exact deductions as to the bearing of pregnancy on the production of gall bladder disease. We, therefore, studied a series of twenty-two pregnant women. The cases were unselected and consecutive, except for the elimination of those in whom there were grounds for thinking that the patient might incur any risk from cholecystography.

In the study we carried out the procedure on all cases having any signs or symptoms of the toxemia of pregnancy. These were four in number. They were of particular interest as we wished to discover whether, in toxemia, the determination of liver function by estimation of the dye retention in the blood stream, combined with cholecystography, is a more delicate indication of decrease of liver function than the dye retention test alone. Subsidiary to this was the question of the relative value of sodium phenoltetraiodophthalein and the other dyes employed in testing liver function.

There were several other directions in which we hoped data of value might be found. The first of these was to determine whether cholecystography was a safe procedure in pregnancy. If it proved to be so, could it contribute anything to the diagnosis of biliary tract disease in pregnant patients suffering from such affections? We desired to know whether cholecystographic findings in pregnancy varied from those in the nonpregnant state. If variations were found, we wished to discover their nature and degree, the time of pregnancy in which they occurred, and the degree of variation at different periods.

Recently Mann and Higgins<sup>1</sup> have studied the effect of pregnancy upon the emptying time of the gall bladder. For their experiments they employed dogs and gophers (chiefly the latter). Pregnant animals were given a fat meal, the abdomen was opened shortly afterward and the size of the gall bladder observed. The animals were not

examined by cholecystography. These authors expressed the opinion that the contractile mechanism of the gastrointestinal tract as a whole is retarded in pregnancy; further, that the gall bladder either does not empty or does so only slowly. They thought that the increase in volume of the abdominal contents was a causative factor in producing the delay. However, they say nothing about the same factor causing delay in the *filling* of the organ. They infer stasis of bile in the gall bladder, and conclude that it originates from both mechanical causes and defective contractility, and that this stasis is contributory to the production of gallstones in the human subject.

We were also interested in the question of the diffusion of cholecystographic dyes through the placenta, and all cases were scrutinized for the appearance of a fetal gall bladder image.

In all the tests the sodium salt of phenoltetraiodophthalein was employed, in the dose and after the method described by Graham, Cole, Copher and Moore.<sup>2</sup>

When cholecystography was carried out postpartum, it was done within fourteen days, except for one case done six months later. The method of making the liver functional test with sodium phenoltetraiodophthalein is quite similar to that employed in using phenoltetrachlorophthalein or bromsulphthalein. Retention of less than 12 per cent of phenoltetraiodophthalein in the blood serum one-half hour after intravenous injection, and less than 4 per cent one hour after, is considered normal, and also if the sum of the one-half hour and hour specimens gives a retention of 16 per cent.

Of the twenty-two cases, four were toxemic and the test was carried out in the twelfth, fourteenth to sixteenth, and two in the fortieth week of gestation. One of these was of such severity that death ultimately resulted in spite of abortion and all treatment. Three patients had a dye retention of from 5 to 10 per cent, but had no signs of toxemia. We have no explanation for this retention. Cholecystography was a failure in one patient because of her enormous size. One patient clinically had cholecystitis. Subtracting these from the total, leaves thirteen apparently normal cases in which there were neither gall bladder symptoms, toxemia, nor dye retention in the blood stream. In this group, six had a non- and two a faint visualization; i.e., eight of the thirteen cases had abnormal cholecystograms and only five of that number, or 38.4 per cent of apparently normal patients gave normal cholecystograms. Three of these were in the thirty-sixth to fortieth, one at the twentieth, and one at the twelfth week of gestation.

It is apparent that an explanation must be sought for the non-visualization of the gall bladder in the eight normal cases. There are several possible reasons for this occurrence. The gall bladder may not fill because of increased intraabdominal tension or pressure on the

organ or its ducts, or pregnancy may so affect the vesicle that it is unable to concentrate the bile. In regard to the first of these two possibilities it is to be noted that though there were five normal cases with nonvisualization of the gall bladder in the thirty-fourth to fortieth week of gestation, there were also three similar cases with normal cholecystograms. This seems to indicate that the mechanical factor of increased intraabdominal pressure, general or local, if a factor at all, is certainly a most inconstant one.

If the gall bladder loses its function of concentrating the bile in the late months of pregnancy, it certainly regains it very rapidly, as shown by the fact that in two cases there was nonvisualization of the gall bladder before, and normal visualization of the organ after delivery, and by two cases which were normal both ante- and postpartum. Our experience with cholecystography in conditions other than pregnancy has shown that if the concentrating function of the gall bladder is lost it is not quickly regained, and when this does take place it occurs after a greater lapse of time than fourteen days.

For the explanation of the nonvisualization of the gall bladder in the normal cases we fall back on the technical difficulties of radiographing a pregnant woman near term. Whatever poses one may employ for this purpose, a large volume of tissue and fluid must be traversed by the x-rays, with the resulting scattering which produces loss of definition. The increased volume of the abdominal contents is another important obstacle from the technical standpoint as it causes the distance of the gall bladder from the film to be increased. The foregoing influences, either singly or combined, can easily render radiography of the dye-filled gall bladder impossible. Our conclusion is that this accounts for the nonvisualization of gall bladders in the normal cases. This belief is strengthened somewhat by the fact that in the smaller subjects the gall bladder was more readily visualized than in those who were larger. A few cases (four) in the first half of pregnancy were readily radiographed and constantly showed normal cholecystograms. For this reason we would incline to the belief that it is abdominal size, and not month of gestation or intrinsic change of the gall bladder, which brings about its nonvisualization.

In the cases of toxemia, the combination of the dye retention test in the blood and cholecystography was not found to be more sensitive or valuable than the dye retention test alone. The fatal case of severe toxemia with 50 per cent dye retention in the blood and with a good visualization of the gall bladder, would indicate that the damage to liver function produced by this condition would have to exceed 50 per cent in order greatly to influence cholecystography. The few cases incorporated in this report indicate that the toxemia of pregnancy does not affect the concentrating function of the gall bladder as revealed by this method of examination.

In none of our cases was a fetal gall bladder observed. This suggests that the cholecystographic dyes do not pass through the placenta. In a case of precipitate labor the dye was injected ten minutes before delivery; examination of the blood from the umbilical cord showed no traces of the presence of dye.

The cases in which there was visualization of the gall bladder do not correspond to the findings of Mann and Higgins<sup>3</sup> as to delay in emptying of the gall bladder nor any other indication of stasis. However, measure of the emptying time of the organ by the use of the fat meal was not carried out.

Where the gall bladder was visualized, the organ corresponded in every respect to that observed in the nonpregnant state, except for modification of its position and the changes incident thereto. Because of the increase in volume of the abdominal contents, the gall bladder assumes a higher and somewhat more lateral position, just as one would anticipate, the degree of this change being proportional to the abdominal size.

The one case of clinical cholecystitis included in the series behaved precisely as a case with such a history and symptoms would do if nonpregnant.

We were unable to find any essential difference in the functional activity of the gall bladder in pregnancy as revealed by cholecystography. We believe that the frequent occurrence of nonvisualization of the gall bladder is due to the radiographic difficulties mentioned above. Accepting this explanation of nonvisualization, the gall bladder has normal ability to concentrate, shows those alterations usually observed in cholecystography of normal subjects, and empties within the usual time.

Sodium phenoltetraiodophthalein is of equal, if not superior, value to the other dyes used in estimating liver function, but largely because of the fact that a greater amount of this dye is employed.

#### CONCLUSIONS

It is difficult to draw many conclusions from such a small series of cases. However, a larger series is scarcely warranted because of the paucity of findings obtained.

Cholecystography is a safe procedure in pregnancy, and sodium phenoltetraiodophthalein has apparently no effect on the uterus. There were no reactions in this series of cases beyond that which would be anticipated in a like number of women patients. In the early months of pregnancy cholecystography is as valuable in the diagnosis of cholecytic disease as it is in the nonpregnant state. The inconstancy of results of this test of gall bladder function when done in the later stages of gestation, renders it of no practical value for gall bladder diagnosis. Neither race nor the number of pregnancies had any ap-

parent bearing on the observed findings. Cholecystography indicates, at least in the early months of pregnancy, that toxemia does not affect the function of the gall bladder as related to the concentration of the dyes employed. Pregnancy modifies cholecystograms only by shifting the location of the gall bladder. One case in which cholecystography was done both ante- and postpartum indicates the return of the vesicle to its usual position after delivery.

This study suggests that factors other than altered function of the gall bladder are responsible for the high incidence of gallstones in women who have borne children. With the method employed we were unable to demonstrate that there was any stasis of bile. It is possible that hypercholesteremia, normal in pregnancy, either itself or the agencies which bring it about have a part in the development of gallstones. It is possible also that cholelithiasis and cholecystitis in women who have borne children are to be attributed to puerperal infection, which might be so mild as to escape notice. The sequence of events being similar to that demonstrated by Graham<sup>4</sup> in the pathogenesis of cholecystitis: a slight or transient infection, drainage to the liver, the development of a low grade of hepatitis with extension to the gall bladder through the intimate lymphatic arrangement between the two organs. The greater the number of pregnancies, the greater the likelihood of a woman having gallstones; also, the greater the likelihood of a puerperal infection. We feel that these points have never been sufficiently considered.

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UNIVERSITY CLUB BUILDING.

## SPURIOUS PREGNANCY\*

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A CONDITION that presents itself from time to time in the practice of obstetrics is that of spurious pregnancy or pseudocyesis. This condition, characterized by signs and symptoms that frequently simulate very closely the signs and symptoms of pregnancy, may at times give rise to extremely embarrassing situations, both to the physician and to the patient. The study of cases of this nature is very interesting and gives one a rather interesting glimpse of abnormal feminine conduct.

Spurious pregnancy is referred to by a number of terms such as: false pregnancy, phantom pregnancy, imaginary pregnancy, hysterical pregnancy, and simulated pregnancy. Although the term "feigned pregnancy" is used synonymously, its use in this respect is an ill chosen one, since it carries the connotation of malingering, or intentional deception, which is not, strictly speaking, a part of the condition under consideration. The French have coined a term to denote the condition, namely, "grosseuse nerveuse."

The literature on the subject is not very comprehensive. Probably the earliest contributions that have been identified, date from 300 B.C. Hippocrates mentions the condition and one may infer from his writings that observations at that time were rather well grounded on recognized cases in animals as well as in humans. From a rather extensive review of the literature of modern medicine the following facts regarding the published work on the subject are obtained.

Spurious pregnancy has been given considerable attention in the middle of the nineteenth century by such authors as Madden, Montgomery, and Simpson. Of all conditions presented to obstetricians and gynecologists spurious pregnancy has probably excited the least published comment. Most mention of the subject appears in the form of case reports presented at meetings of local medical societies. These cases are reported mainly as interesting examples of abnormal human behavior, or as examples of patients who should have been examined early by the physician in charge. Very few conjectures have been advanced as to the why or as to the wherefore of the condition.

On account of the nature of the condition only a few of the cases are ever seen in hospital practice. Most of the cases are seen in the office or the dispensary where the diagnosis is made before the patient reaches the supposed date of confinement. Horrocks reported a hospital case from Guy's Hospital Reports in 1884. Rosensohn reported ten cases from the antepartum service of the Lying-In Hospital in *Bulletin of Lying-In Hospital* of New York in 1922. These cases were collected over the period of one year, from 1916-1917.

Spurious pregnancy is seen in animals and several references to such cases are made in the literature. These will be considered later. Although no accurate data is at hand to verify the assumption, the condition is probably common to all

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ances. At least twelve countries are represented in the literature on the subject, and the territory included all continents and was distributed from Scandinavia to South Africa.

It is my experience that in the dispensary more white patients are seen with imaginary pregnancy, than colored, although the colored attendance outnumbers the white by approximately two to one. Practically all of the cases in the literature are reported about white subjects.

There is considerable difference of opinion as to the age at which most cases appear. In most instances recorded, the patients were between 25 and 35 years of age. Simpson states that most cases are seen at the climacteric period. Montgomery thinks that it occurs most frequently at the climacteric period. The reports in the literature do not bear out the latter statement.

As a result of personal observation I believe that most of the cases occur in young individuals who, because of exposure to pregnancy and the undesirability of pregnancy, imagine themselves pregnant. These cases do not present themselves for observation early, on account of the embarrassment attending such visits to the physician, but keep their own council until they are convinced that they are, or are not pregnant. Some of these patients hasten to the sympathetic midwife or the near-by apothecary where the products of imagination may be dispelled as easily as one discards a bit of tissue.

From observations in the dispensary and from reviewing the numerous cases in the literature one may divide the cases into three general types:

First, those women in whom there is a decided fear of pregnancy or an aversion to pregnancy.

Second, women who are extremely desirous of becoming pregnant.

Third, those cases in whom pregnancy is imagined because of some functional disturbance attended by symptoms which simulate the signs or symptoms of pregnancy.

In the first class come the young individuals mentioned above.

Many of these are young girls who after illicit intercourse begin to build up a sort of aura of pregnancy. All sorts of emotional conflicts go on. Minor disturbances are interpreted in the light of a prospective pregnancy with its attending shame and uncertain outcome, until the entire organism is thrown out of balance and pseudocyesis is the condition requiring treatment.

In the newly married women similar emotional disturbances often take place, though usually not as marked or as persistent.

In many cases it is extremely difficult to get to the cause of the exciting factors other than the history of some previous illicit intercourse. In two cases, seen in the obstetric dispensary within the past year, the patients were both minors in whom the history of previous

intercourse had no direct connection with the spurious pregnancy, for which they were under observation. Both of these patients had mental ages far below their ages in years.

In making inquiry as to why pregnancy was suspected it was found in each case that on admission of previous intercourse to their mothers, and the development of some presumptive sign of pregnancy, the suggestion was so strongly impressed on the patient, that each girl believed herself actually pregnant and became a full blown case of spurious pregnancy. From the analysis of the social conditions surrounding many of these patients in their homes and places of employment, I believe that many cases are developed from just such surroundings.

A brief outline of one of the cases mentioned above will be of interest here.

F. G., white, aged twenty, single, entered obstetric clinic October 6, 1927. Patient was a rather dull type with the appearance of low mental age. This was subsequently determined as nine to ten years in the neurologic clinic.

Menses started at twelve years and were regular every twenty-eight days with a moderate flow, lasting seven to eight days. Her history, which was subsequently verified, was that on July 3, 1927, she had been forcibly attacked. This attack had been made while she was away from home, against the wishes of her mother. On her return home her mother had become quite abusive and suspected pregnancy at once. The next two menstrual periods became short and scanty, and the following month she did not menstruate. At this time she was sent away from home, and she then became more or less of an outcast.

On admission to the dispensary she was thoroughly convinced of her pregnancy. She complained of nausea and vomiting existing for three weeks, hot flashes, and headaches. Her weight had increased and the abdomen was getting larger. On examination the breasts were found somewhat congested. The abdomen was somewhat enlarged. The uterus could not be felt because of the resistance of the patient and tenderness. Two weeks later examination failed to reveal any further evidence of pregnancy, but it was thought advisable to keep the patient under observation.

For some reason the patient did not return until January 4, 1928. At this time she was still of the opinion that she was pregnant. Nausea was still present though not severe. No menstruation had occurred. The abdomen was larger and the weight had increased 16 pounds since first visit. The uterus was not enlarged. Patient mentioned some indefinite movements in right side which she interpreted as fetal movements. She was told that she was not pregnant but refused to be convinced.

Two weeks later she returned with history of a slight fall a few days before, followed by some pain in side, a few cramps, and a slight bloody discharge on the day of the visit. This discharge had the appearance of a scanty menstrual flow. She was told that this was probably a menstruation and that she likely would menstruate the next month. There had been no increase in the abdomen, and the weight had diminished slightly.

Meanwhile the social condition of the patient had been benefited, and a more satisfactory adjustment of environment had been made. The patient has menstruated normally since and no longer believes herself to be pregnant.

The second type or those who are extremely desirous of becoming pregnant probably present the most extensive picture of spurious pregnancy and are most difficult to convince that their assumptions are wrong. These women are usually older and with their better knowledge of signs and symptoms of pregnancy present a more complete picture of pseudocyesis.

Oftentimes pregnancy in such patients would be of decided advantage from an economic standpoint such as the participation of children in the inheritance of an estate, or in the fixing of an amount of alimony. Often the desire to hold the love of the husband and preserve the marital state is the exciting factor. The condition is noted especially in women who have been married a number of years and are approaching the menopause, without ever having become pregnant.

In two cases that I was able to observe I found that both patients had been married before without issue. In the second marriage both wished to have children, partly because they themselves desired them and partly to convince their husbands that they were not barren. In a number of cases that I have questioned, the fear of sterility seemed to be sufficient to cause the patients to look forward eagerly to any symptom of pregnancy. Probably the greatest exciting factor in spurious pregnancy in this class of patients is the maternal instinct.

It is in this type of case that the condition is most marked and may continue to a later false labor. Many of these patients make rather elaborate preparation for delivery and the reception of the newborn child.

A case under observation a few years ago illustrated many of these features.

M. S., white, aged twenty-seven, gravida i, requested an obstetric examination to determine the duration of a supposed pregnancy. Her previous history was that of irregular menses beginning at fourteen years and remaining irregular until nineteen when some pelvic operation was done. One normal pregnancy six years ago by first husband. Following the pregnancy there was a history of a pelvic inflammatory condition.

Second marriage two years previous to my observation. Patient stated that since her pelvic distress she was afraid that she could never conceive again. Present husband very desirous of children. No contraceptives.

For four or five months she had noted enlargement of abdomen and a gain of 25 pounds in weight. Menses had been very scanty and painful. Nausea had been troublesome almost daily, with vomiting one to two times daily. Patient noted edema of hands and feet. Fetal movements felt for some time by patient. She believed that she was rather near term, four or five weeks.

When I first saw the patient she was making baby clothes. On examination the breasts showed some enlargement. The abdomen was quite large with a very thick panniculus. No abdominal mass was felt; although the patient resisted considerably and seemed to make the abdomen larger. The uterus was only slightly enlarged if at all. There was a small tender mass in the region of the left adnexa. Patient was very much put out on being told that there was no evidence of any

advanced pregnancy. Ten days later, at the regular menstrual time, she had a rather profuse menstruation with some pain. Following this all symptoms disappeared. Since that time she has had two labors at term and one miscarriage.

In the type of patients that have spurious pregnancy associated with some functional disturbance, the cessation of menstruation is probably the most common causative factor. Most of these cases are in women approaching the menopause when emotional reactions are a part of the menopause symptoms. As the periods cease or become scanty, with the increase in weight or enlargement of the abdomen that so many women experience, it is not at all unlikely that the possibility of pregnancy would suggest itself to the woman. This suggestion in the mind of one whose emotions are already in a state of unrest may easily become a child of imagination.

Numerous other disturbances of function may be the exciting factors in the production of spurious pregnancy. Endocrine disorders which have symptoms common to pregnancy sometimes give rise to the picture. Montgomery, and later Madden mention a number of disturbances such as ovarian tumors, ascites, obesity, visceroptosis, and flatus among the exciting factors of the condition. It will be noted that these disturbances occur frequently near the menopause.

It is interesting to note the prevalence of certain signs and symptoms in these cases. Although many cases simulate real pregnancy very closely, it has been pointed out by Montgomery that almost all of them give a history of some phase of the condition that does not follow the normal course of pregnancy. Some may menstruate a number of times after the supposed pregnancy is well advanced. Others may feel life at an unusually early date for a pregnancy. In many cases the long persistence of nausea and vomiting may be quite unusual.

In following through the reported cases a number of signs were studied. As might be expected disturbances of menstruation were the most common disorders. Nearly every case noted had some menstrual disturbance. Nearly every patient missed entirely one period, and over half of the patients did not menstruate as long as the supposed pregnancy existed. The cessation of menses is extremely important to the patient, and as Rosensohn indicates, often is the beginning of a "train of subsequent signs." Not infrequently scant menstruation is the menstrual disturbance encountered.

Changes in the breasts are one of the most frequent signs in instances of imaginary pregnancy. The cases in the literature are not complete enough to tabulate this feature in the symptom complex. In the great majority of cases breast changes were present. About half of these cases showed the presence of some secretion. Increased pigmentation of the areola was observed in a number of instances, but

there is always some reason for doubt about this sign as is also true in regard to vaginal mucosa discoloration.

Nausea and vomiting are present in probably as many as 80 per cent of the cases. Here again there is usually some deviation from the normal course of events. In the early cases, especially those who fear illegitimate pregnancy, nausea and vomiting may occur unusually early and are frequently unusually severe. In a number of instances the nausea and vomiting started before the menstrual period was missed. At times the disturbance becomes so severe that it requires special treatment. In these severe cases, although the gastric disturbance may be a part of some other disorder, the patient is all the more strongly convinced that she is pregnant. This is emphasized in instances where previous pregnancy has been attended by severe gastric disturbances.

Quickening is present in most of the cases in which the imaginary pregnancy lasts five months or longer. It is most frequently observed in the older individuals. This is probably true on account of the disorders that lead these women to imagine pregnancy, such as gas in the intestines, abdominal distention, tumors, and excessive fat deposits. A number of these women give a history of quickening felt long before it would be expected in normal pregnancy. The history of unusually active fetal movements is not at all uncommon.

Although discoloration of the mucous membrane is not always easily distinguished, it appears that in most cases of imaginary pregnancy that have been carefully studied, this sign was absent. Other conditions causing pelvic congestion make this sign a rather doubtful one, as it may be observed in patients who are not pregnant or in whom there is no suspected pregnancy.

In one or two instances of spurious pregnancy abnormalities of pigmentation have been noted. These were probably due to endocrine disturbances, which were responsible for the functional changes that caused the women to believe that pregnancy was present.

On observing a number of histories of imaginary pregnancy, it is noted that in a small number frequency of urination is noted. In some cases this is probably due to the nervousness of the patients, while in others it is due to pressure or irritation by tumors in the abdomen. This is certainly not a frequent symptom.

Practically all of these women suffer from mental and emotional changes. This is a part of the very condition that makes up the picture of spurious pregnancy. Although some women attribute their emotional disturbances to their supposed pregnancy, the imagination of pregnancy itself is the result of some mental reaction. Occasionally the supposition of pregnancy is the outstanding delusion in a psychosis, but these cases are not characteristic of the emotional

changes of spurious pregnancy. Some of the earlier writers regarded pseudocyesis as a monomania.

Some patients do cling to the delusion long after they have been informed that the pregnancy was only mythical. Montgomery cites one case of nine years' duration. Simpson mentions a patient, seen by Dupuytren, in which case the delusion was kept up for fourteen years.

Practically all cases in which the weight was noted showed some increase in weight. This gain was most noticeable in those cases associated with the menopause. In the case of the young woman I mentioned the increase was sixteen pounds over a period of three months.

Enlargement of the abdomen usually accompanies spurious pregnancy. In a number of cases tumors have been apparent to the examining physician. Phantom tumors do not always simulate the gravid uterus. In several instances the phantom tumors have simulated some other intraabdominal masses. The apparent masses have been caused by involuntary or voluntary rigidity of the abdominal wall, thickening of the wall, distention, by gas or fluids, or similar factors. These supposed tumors usually disappear during anesthesia or while the attention of the patient is diverted.

Naturally the positive signs of pregnancy are absent in the condition. Formerly, before modern obstetric procedures were applied to the cases presenting themselves as obstetric patients, errors in diagnosis were common. Palpation of the abdomen in supposed pregnancy would sometimes lead to the impression that fetal movements were present, when only movement of the intestines or gas within the intestines was felt. This phenomenon together with enlargement of the abdomen has confused many medical men, and has in two recorded cases been the determining sign on which laparotomy was performed.

An essay of this nature is scarcely complete without some mention of the termination of these cases. Most of the patients, when told that they are not pregnant, show considerable doubt as to the correctness of the advice of the physician. Many of these women refuse to be convinced that their pregnancy is only imaginary, and will go from one consultant to another repeatedly, apparently never quite convinced of the error of their assumption. Some patients react rather violently to the correct information and will take absurd measures to convince medical attendants that pregnancy is or has been the case. Some will feign a miscarriage as in the cases reported by Pracy, and by Ellsworth. Nielson displays a large number of small bones of birds, that a patient claimed to have passed per rectum in a case of spurious extrauterine pregnancy.

A number of cases of spurious pregnancy go on to spurious labors. When multiparae simulate labor the effect may be very convincing. By virtue of previous experience the regularity of contractions, with

all the attending agony and sounds, may be very successfully imitated. The early literature on the subject graphically describes a number of such labors.

Although the condition has been recognized for centuries, there has been little study given as to its cause. We can easily see why some women should suppose themselves to be pregnant, or why some delusions should include the supposition of pregnancy. It is not so simple, however, to explain the rather definite progression of signs and symptoms that frequently go along to make the spurious pregnancy seem real to the patient and apparent to the observer. I find that in the discussion of most of the reported cases the condition has been ascribed to hysteria. Although the statement is frequently seen that hysteria may simulate almost any condition, it is difficult to explain spurious pregnancy on that basis. A number of these cases do probably represent hysteria, but by no means do all of them do that.

Montgomery who has presented an excellent treatise on simulated pregnancy rather discourages explanation of the condition. Harvey, and later Schmitt, advanced theories which included the supposition of a close relationship between the receptivity of the brain and of the uterus. These theories would indicate that as coitus occurs, there is conceived within the brain the idea of pregnancy which is fostered as the uterus would foster the developing ovum; or "that a woman should be impregnated by the conception of a general immaterial 'idea' and become the artificer of generation."

Hofstaetter emphasizes the disturbance of endocrine function as a probable cause of the condition. Others point out its association with various mental diseases, such as, paranoia, dementia precox, epilepsy, and feeble-mindedness. None of these mental disturbances, however, represent per se the starting point for spurious pregnancy.

Doerfler attributes the situation to a disturbance of the patient's psyche that leads to the supposition of pregnancy and to the physical changes seen. This may be the key to the situation but for its solution one must go to more fundamental manifestations.

Throughout the lower animal world excellent examples of pseudocyesis have been observed repeatedly. Hippocrates mentioned the condition in lower animals as well as in humans.

Harvey recorded the condition in dogs. Some of these were dogs that had had intercourse without conception following, while others showed the picture without intercourse having taken place. Instances were noted where the actions of the animals simulated the actions of bitches in labor. Examples of similar behavior are frequently noted in fowls where the female has the desire to set but has no eggs to set on.

Haughton was able to produce the picture of phantom pregnancy in the female ass, and to reproduce the condition for verification.

With these instances of animal behavior in mind it is not advisable to limit too closely our presumptions as applied to the humans. It would be rather difficult to attribute phantom pregnancy in the ass to dementia precox; or in the dog to hysteria or paranoid.

Haughton speaks of a feminine attribute, the maternal instinct. Liepmann analyzes phantom pregnancy from a so-called law of the threefold substratum of the female psyche, which he says runs through the entire animal kingdom; namely, inhibition, vulnerability and pansexuality.

It seems that these two writers have certainly indicated the essentials in studying this interesting problem. The thought of a maternal instinct common to all species is certainly a logical deduction. The ancients recognized maternal instinct and the Greeks gave it a name, "storge."

In woman there is that inherent maternal instinct. Her ultimate purpose is to produce offspring. What normal woman is there who does not at some time in her life desire or speculate on having children?

In humans we have the power to think and reason. Primitive to that power lie the instincts. When by artificial restrictions such as the laws of society, physical disability or lack of contact with suitable mates, the instincts are curbed, then an emotional conflict occurs. This emotional conflict goes on between those inherent instincts and the impression one obtains from the inhibiting agency. This does not involve any process of reasoning. As examples of these curbing factors in the case of lower animals, I mention the bars of the cage, the dwarfed animal, or the different genus of the mate, as studied by Haughton.

In the human there are other influences which serve to increase the conflict. Fear, shame, remorse, desire, dislike, and a number of other impressions are founded on reason and experience. When instinct conveys to the female organism the impression that pregnancy is probable, or should be the case, then the entire organism undergoes a reaction. Thoughts of pregnancy are evolved concerning the possibility of pregnancy and the consequences resulting from that condition. These thoughts are increased by desire or dread of pregnancy, or by some functional disturbance denoting that pregnancy is probable.

There is then, on the one hand, instinct calling for pregnancy with an attempt to simulate reactions common to pregnancy. On the other hand, we have conclusions formed as a result of thoughts on the subject.

If these conclusions coincide with the promptings of instinct, the picture of pregnancy results. This picture becomes more and more fixed in the mind of the patient giving rise to a chain of signs and symptoms brought about by emotional disturbances. This continues until stronger conclusions to the contrary are derived, being induced



by the conclusions of the examining consultant, or as a result of physical manifestations ruling against pregnancy.

If on the contrary the mental conclusions are negative to the proposition presented by instinct, then the woman dismisses the possibility and looks elsewhere for the source of functional disturbances, if any are present.

I believe that the conclusions that I have just presented in regard to spurious pregnancy will apply to almost all cases of the condition. These conclusions also seem to explain the greater frequency of the condition in women of limited mental capacity, which fact I believe is true, from cases studied in the literature and from cases coming under my own observation. The relation between emotional disturbances and functional disturbances I have not attempted to explain. Possibly an understanding of this phase would give us a better key to the situation.

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## RADIATION THERAPY IN GYNECOLOGY\*

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SINCE the advent of radiation therapy, gynecology has offered a most fertile field for its employment in the treatment of women's ills. My object is to present an outline of the work that for the past three years has been carried on with a gratifying measure of success by the Radiation Therapy service of the largest public general hospital of the metropolis. It is only three years ago that at the instance of Dr. Frederick C. Holden, radiation therapy in gynecologic conditions was made available to patients on his service at Bellevue. During this comparatively brief time we have been able to work out a few definite ideas as to the advisability of its use in gynecology. As employed by us, radiation therapy makes use of the radiant energy of x-rays, radium, and the high frequency current.

As a normal routine, all cases are divided into two main groups, those which have benign and those which have malignant lesions. While the same modalities are used in both groups, the method of procedure and employment varies according to the condition of the patient, and as to whether the lesion is malignant or nonmalignant, and if malignant, whether primary or a recurrent lesion.

Bellevue, being a general municipal hospital, receives all kinds and types of gynecologic patients. At the first examining post of the gynecologic service, it is decided whether or not the patient requires hospitalization. It has been found that but a few conditions can be treated with radiation therapy in an ambulatory manner, the vast majority of cases referred for radiation must be hospitalized.

In that very large group of patients suffering from benign conditions, surgical procedure is usually the method of choice. However, even in the benign cases, radiation can be properly employed, as for example, where the patient is a poor surgical risk, or where surgery has been attempted and failed, or where other medical or social reasons oppose surgical interference.

In the malignancies of the pelvis, radiation has shown such unmistakably good results, that its use in these conditions has now become quite a routine procedure. At Bellevue, malignancy of the cervix is in fact no longer regarded a surgical condition, and in this type of lesion the entire brunt of treatment is borne by radiation alone. In many of the other pelvic lesions, radiation shares equally with surgery in the attempt to control the condition, while in numer-

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ous instances it is relied upon to counteract the dissemination of disease engendered by previous surgical interference.

It is not our province, however, to allocate precisely where and when radiation should replace surgical therapy. Our policy has been rather to cooperate fully and freely with the gynecologist in order that the patient may reap the benefit of our combined study and service. Frequently the pathologic picture presented required special study, and tissue analysis was done in all cases where possible. Our association with the gynecologic and pathologic services has been a most happy one, and in Drs. Holden and Symmers, we have found an unusually fine spirit of open minded cooperation.

During the period of 1925 to 1927, 255 gynecologic cases were treated with radiation. Of these, 111 were malignant and 144 were benign.

In the benign group, the conditions treated were:

1. Newgrowths in the pelvis: (a) myoma uteri; (b) benign growths of the vulva and vagina; (c) urethral caruncle.
2. Functional conditions: (a) amenorrhea; (b) dysmenorrhea; (c) metrorrhagia.
3. Dermatologic conditions: (a) eczema; (b) pruritus.
4. Inflammatory conditions of the (a) adnexa and (b) joints.
5. Tuberculosis of (a) peritoneum; (b) adnexa; (c) cervix.

The following malignant conditions have been treated: carcinoma of the vulva, vagina, urethra, cervix, uterus, adnexa, and ovary; sarcoma of the ovary, uterus, and cervix; myxosarcoma; metastatic foci.

As has been shown, therefore, a great many conditions are treated with highly gratifying results by radiation. This form of therapy, however, is not offered as a universal panacea for the cure of all gynecologic diseases, but, where judiciously and properly employed, it offers a form of therapy which either alone or as an adjunct to surgery, very often relieves conditions in which all other forms of therapy have failed.

In general, then, what can radiation offer in the way of therapy? What type of radiation should be utilized in a given condition, and finally, what are the contraindications to its use? To answer briefly, radiation when properly used can cure certain conditions, it can ameliorate the severity of others, it can help to render operable some conditions which might otherwise be classed as inoperable, and finally act as a palliative in advanced malignancies.

The type of modality to be used in any given case varies with the type, location, histology, and extent of the lesion; e.g., in malignancy of the ovary or of the body of the uterus where surgical removal is still feasible, surgery is first employed, followed by radiation. As a general rule, large deep-seated lesions with or without disseminated

metastases, are treated by high voltage x-rays, while localized lesions or those easily gotten at from surface openings are treated with radium. Inflammatory lesions are treated by x-rays. Medical diathermy is indicated in chronic adnexal infections and in the painful lesions of pelvis and back of idiopathic origin. In the treatment of cervical malignancies, a combination of x-rays and radium is employed. Large bulky tumors are first treated by removal of the mass, preferably by surgical endothermy, then radiated.

Regarding medical diathermy, we began using this method of therapy only a short time ago, but the results obtained warrant our continuing its use. In those cases where there is a persistent adnexal involvement, with board-like abdomen, tenderness and no discharge, we have found that small repeated daily doses of moderate diathermic heat to the pelvis have given many good results. The hard frozen pelvis has softened down, the exudate has been absorbed and in some cases the pus has been centered to an easily drained area. Often a nondraining sinus to a supposed pus pocket is made to drain by diathermy.

Some really gratifying results have been achieved by its judicious use in idiopathic pains of the back, and in those painful postoperative pelvic cases which defy all sorts of other therapy. Diathermy is not a cure-all, nor is it indicated in all cases, but when properly used does give results that are gratifying to the patient and doctor.

The application of radium is contraindicated in infectious lesions, it is always a surgical procedure, and the rules for proper surgical manipulation apply to its use as well. X-ray treatment, on the other hand, can be given to an ambulatory patient, it does not require keeping the patient in bed and is not contraindicated in infectious conditions, except in rare instances.

In the matter of transfusions, we believe they enhance the value of radiation therapy in all cases where body resistance is lowered. The same rules governing the reasons for transfusions in other medical or surgical conditions apply equally well in connection with radiation therapy. If possible, transfusion should be given in all cases of malignancy before radiation treatment is carried out. Transfusions in addition to general body hygiene and building up of the patient's strength materially aid recuperation.

Specifically, radiation may destroy tissue or merely inhibit its growth or action, on the other hand it may stimulate tissue growth or action. When used in mild doses, radiation causes a response which is interpreted as being a stimulation reaction of body tissue; when used in severe dosage, the tissue or its functional reactions are more or less completely destroyed. The proper use of radiation nicely harmonizes these known reactions with the expected therapeutic results.

## SUMMARY

The x-rays are used generally in all benign and tuberculous lesions, in functional disturbances, in metastatic and widespread malignant conditions, as a postoperative aid to surgery in malignant conditions, and finally in such cases where only a palliative effect can be hoped for.

High voltage x-rays yield excellent results in fibroids, excepting the submucous type, and in functional disturbances such as amenorrhea, sterility, and dysmenorrhea.

Among the patients we see at Bellevue, amenorrhea is not a condition for which relief is sought; it is but part of the symptom complex. We have treated thirteen patients, of these 6 were married and 7 were single. The oldest was thirty, the youngest seventeen years old. The shortest period of amenorrhea was two, the longest period twenty-five months.

Results: menstruated, 9 or 69 per cent; failed to menstruate, none; unknown results, 4 or 21 per cent.

In metrorrhagias of specific or idiopathic origin where surgery is contraindicated, high voltage x-rays usually bring prompt relief. In fibroid uterine lesions we consider radiation indicated when surgical interference is contraindicated, when the childbearing period is past, when the patient refuses operation, or when sterilization is required for other associated lesions. Our belief is that the size and condition of the tumor have no bearing on the question of the feasibility of radiation.

The total number of fibroid cases treated was 60, the youngest patient being twenty-four, and the oldest seventy-three years old.

Ages: 20 between twenty-four and twenty-nine years; 29 between forty and forty-six; 7 between forty-seven and fifty-nine; and 1 between sixty and seventy-three years. Age not given in three cases.

Of these 60 patients, 12 were single, 39 were married, and 9 were widows.

Infection was present in 9 cases or 15 per cent; not present in 51 cases or 85 per cent.

Twenty-two, or 37 per cent, had no children; 10, or 16 per cent, had one; 25, or 42 per cent, more than one child. Concerning 3, or 5 per cent, no information available.

Ten, or 16 per cent, had one; 16, or 27 per cent, several; and 34, or 57 per cent, had no miscarriage.

Symptoms recorded: bleeding in 44, or 57 per cent; of these excessive bleeding in 18, or 30 per cent; palpable tumor mass in 41; tumor at umbilicus or above in 1, fairly large, 18; no tumor palpable in 19, or 32 per cent, of cases, probably submucous tumor in 1.

Treatment: x-rays alone, 57; radium alone, 6; x-rays and radium, 2; operation following x-rays, 3; operation following x-rays and radium, 2.

Results: bleeding stopped, 39, or 65 per cent; failures, 4, or 7 per cent; unknown results, 17, or 28 per cent.

Failures: death following x-rays, none; death following x-rays and radium, 1; failure by x-rays alone, 3, or 5 per cent; failure by x-rays and radium, 2, or 3 per cent.

Regarding therapeutic abortions by the x-rays, we have been successful in only three cases out of nine so treated.

In tuberculous lesions of the pelvis, x-rays give prompt relief, and in those cases of persistent sinus often cure the condition. In tuberculosis of the cervix, radium therapy is the method of choice.

In malignancy of the cervix, the type and histology of the lesion determine the particular method of procedure and the result. The more adult the type of tumor tissue, the more involved the lesion is, and the less it reacts to radiation, and therefore the more malignant the condition.

In the 72 treated cases in our series, 2 cases were early operable, 70 were inoperable, advanced. Of these 11 cases were recurrences, following previous operations or radiations. In all cases radiation was preceded by hygienic treatment through nourishing feeding and daily bowel and vaginal cleansing.

Radiation was given by x-rays and radium, and in five cases, the large cervix tumor mass was first removed by endothermy.

The details of the cases treated are as follows: Of these 72 patients 59, or 82 per cent, were white and 13, or 18 per cent, colored. Fifty-one were married, none single, and 21 widowed.

The youngest was twenty-six, the oldest eighty-four years old. The ages ranging between twenty-six and thirty in 5; thirty-one and forty in 20; forty-one and fifty in 29; fifty-one and sixty in 16; sixty-one and eighty-four in 5 cases.

Three, or 4 per cent, had no children; 15, or 21 per cent, one child, and 54, or 75 per cent, two or more children.

There were noted: miscarriages, in 29, or 40 per cent; normal labor in 63, or 87 per cent; difficult labor in 6, or 8 per cent.

The condition was found operable in 2, or 3 per cent; inoperable in 70, or 97 per cent.

Previous treatment was noted in 25, or 35 per cent, and previous operation in 22: 9 hysterectomies, 2 cervix amputations, and 11 other gynecologic operations.

Previous radiation was recorded in 3 and no previous treatment in 47, or 65 per cent, of the cases.

The stage of disease was as follows: primary, 61, or 84 per cent; recurrence, 11, or 16 per cent; following operation, 10; following previous radiation, 1.

Condition of lesion: limited to cervix in 2, or 3 per cent; parametrial involvement in 70, or 97 per cent; excavated lesion, in 6, or

8 per cent; hypertrophied or cauliflower type in 6, or 8 per cent, accompanied by vaginal involvement in 7, or 9 per cent.

Histology: basal cell in 2, or 3 per cent; squamous cell in 14, or 19 per cent; plexiform in 33, or 46 per cent; adenocarcinoma in 10, or 14 per cent; undifferentiated in 13, or 18 per cent.

Wassermanns were found: positive in 6, or 8 per cent; negative in 56, or 78 per cent, and unknown in 10, or 14 per cent.

Treatment consisted in: x-ray alone in 14; radium alone in 3; x-ray and radium in 49; and endothermy, x-ray and radium in 5.

Results: known dead, 12, or 16 per cent; known living, 40, or 56 per cent; unknown, 20, or 28 per cent.

Analysis of death: occurred following treatment in 1 case; occurred five, seven, nine, ten, twelve, and fourteen months after treatment in 1 case each; thirteen months after treatment in 2 cases, and 17 months after treatment in 3 cases.

Causes of death: uremia, in 1 case; asthenia and cachexia in 10 cases; advancement of disease with terminal hemorrhage in 1 case.

Histology of the lesion of the 12 known dead: plexiform epithelioma in 8 cases; squamous-cell epithelioma in 2 cases; and adenocarcinoma in 2 cases.

In conclusion, radiation is a really helpful means of treating many gynecologic conditions. It is not a panacea for all lesions, nor is it the method of choice in the treatment of all conditions, but when properly, judiciously and carefully used, radiation is a potent factor in the care of the gynecologic patient.

The radiation therapist and the gynecologist must cooperate, and surgical judgment must be followed in deciding the course of treatment.

The rôle of radiation therapist is not an easy one in the family of medical specialists, but if he will constantly cooperate with the gynecologist, and treat each case as an individual entity, using the judgment of his colleague with regard to the course of treatment to be pursued, the results that will be obtained will prove highly gratifying to all concerned.

# GONOCOCCUS INFECTION IN FEMALE CHILDREN

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GONOCOCCUS infection of the genital organs in infants and young girls is a condition which concerns the general practitioner and the gynecologist, as well as the pediatrician, to whom it presents an ever present menace. The innocence of the acquired infection, the difficulties encountered in diagnosis, the necessity for prolonged treatment, the practical impossibility of pronouncing a patient cured, and the frequency of recurrences are phases of the disease which justify any contribution concerned with pathology, diagnosis, or treatment. We have studied 42 cases of definite gonococcal vulvovaginitis, which have come under the care of the department during the past two years. In each patient the gonococci were demonstrated in the secretions either at the time of admission or subsequently.

## AGE INCIDENCE

The average age of the patients was six and one-half years, the oldest child being twelve years and the youngest nine months.

## SOURCE OF INFECTION

In the majority of these cases we have been unable to determine the probable etiology with any definiteness, although in 13 patients where the history was quite clear cut, it was indicated that contamination from other infected members of the family played the greatest rôle, since in four cases the father, in two the mother, and in one an older sister were known to have had the disease. Two other patients apparently contracted the disease from playmates who were known to have had a vaginal discharge; in three of the older children rape was indicated, and one child became infected during an epidemic in a Children's Home. It is worthy of note that when one child becomes infected, the other female children in the family usually contract the disease, unless effective isolation is practiced. We have noted three such families where all the female children were under treatment. It might possibly be assumed that in the older children attempted intercourse was a factor, although direct evidence is lacking. In no instance was the disease contracted by direct contact with an infected mother at the time of birth. It may be that children born of gonorrheal mothers have an immunity which protects them for some time and explains why even in a large venereal obstetric clinic infection at the time of birth is rarely noted.



## DIAGNOSIS

We still feel that the most reliable method of diagnosis is the close correlation of the physical findings with a careful examination of smears stained with the Gram method. Burke's<sup>1</sup> modification of the original Gram stain is most satisfactory. Positive findings are usually easily made when the disease is recent but become more difficult as the infection becomes chronic. Our experience with diagnostic cultures agrees very closely with that of Stein,<sup>2, 3</sup> that they cannot be relied upon. We have never obtained a positive culture where the smear examination was negative, but in approximately one-half the cases with positive smears, we have been unable to grow the organism. We have had no personal experience with the complement fixation or with the skin test.

## METHOD OF EXAMINATION

As early as 1893, Koplick<sup>4</sup> expressed the opinion that the vagina was the seat of the infection but that involvement of the cervix was frequently present and explained the intractable nature of the disease. Scommazoni<sup>5</sup> and Hess<sup>6, 7</sup>, who have had opportunities to study under the microscope the cervixes of children who had died from intercurrent diseases have reported evidences of cervical inflammation. In 1924, Randall,<sup>8</sup> from this clinic, reported 11 children with vulvovaginitis which was resistant to the ordinary methods of treatment, and in 5 of whom examination with the vaginoscope revealed the presence of cervical disease.

With these facts in mind, our routine demands examination of the cervix through an electrically lighted, Koch, eight-centimeter urethroscope of appropriate size (22 to 26, French). A short instrument is preferable, since the manipulations incident to obtaining smears and giving treatments are more easily carried out than when longer instruments are used. As a rule, the instrument can be passed through the hymenal orifice without difficulty, but occasionally incision of the hymen may be necessary. With the child on the edge of the table and with the hips elevated, the urethroscope is passed into the vagina and a careful inspection made. Usually the cervix as well as the vaginal walls are reddened, while occasionally small punctate hemorrhagic areas are visible, and frequently a drop of pus protrudes from the external os. After the cervix has been cleansed with a small piece of cotton on the end of a nasal applicator, a fine platinum loop is passed into the cervical canal and material obtained for smear examination. The smear is prepared by tapping the loop gently into a small drop of distilled water on the slide. Other smears are taken from the vagina, vulva, and urethra as indicated, and more recently also from the rectum.

## FINDINGS

Of the 42 cases thus examined at the time of admission, 40, or 95 per cent, showed gonococci in the cervical smears before we had instituted any treatment. Approximately one-half of the cases had had

treatments elsewhere, leaving 20 children with gonococci in the cervix before any treatment had been given. In the patients who had been treated, there is the possibility that vaginal irrigations had washed the organisms into the cervical canal, but in 20 of the cases this cannot be argued, since there had been no treatment.

It seems logical that the cervical involvement would occur chiefly in the chronic form of the disease, but our experience would indicate that it is also present in the early stages of the infection. Two of our patients had contracted the infection only two weeks before admission, and had been brought to the hospital very shortly after the appearance of the discharge, while another case was of not more than three weeks' duration. In none of these children had there been any previous manipulations or irrigations, but the smears from the cervix showed gonococci.

The organisms were obtained in smears from the urethra in only 9 of the cases, or 21 per cent, the ages of the children varying from six to eleven years.

Although Fraser<sup>9, 10</sup> reports having found the organisms in the rectums in 59 of 63 cases, we have been unable to demonstrate them in any of a considerable number of our more recent admissions. Tod<sup>11</sup> apparently has had a similar experience.

#### COMPLICATIONS

None of the more usual complications of gonorrhea as seen in the adult female, salpingitis, peritonitis, arthritis, or ophthalmia were observed in this series, although there are many such cases recorded in literature. We consider the cervicitis an almost constant finding, and as such do not consider it a complication.

#### TREATMENT

It is generally recognized that hygienic measures, including a daily bath and frequent cleansing of the vulva, are important in the treatment of gonorrhea in the female child, but there is as yet no uniformity of opinion as to the germicide which is most efficacious. Our routine treatment includes twice-daily, hot, vaginal douches with saline solution. Immediately after the morning douche, the cervix is exposed through a urethroscope and a gonococcide applied to the cervical canal by means of a nasal applicator. The portio and the vaginal vaults are painted thoroughly, and the lower vaginal walls are treated as the instrument is withdrawn slowly. The same antiseptic is applied to the vestibule and vulva, and a few drops are instilled into the urethra.

In a clinical test to establish for ourselves the relative efficacy of various methods of treatment, we compared the time required for smears to become negative and to remain negative for three consecutive weeks under treatment and for an additional week without treat-

ment. Smears were taken weekly, all treatment being omitted on the day preceding this examination. As shown in Table I, 5 per cent mercurochrome was the most effective of the remedies we tried.

TABLE I. RESULTS WITH VARIOUS ANTISEPTICS

DRUG	AVERAGE NUMBER OF WEEKS FOR SMEARS TO BECOME NEGATIVE
Mercurochrome, 5 per cent	2½
Mercurochrome, 2 per cent	4
Mercurochrome ointment, 2 per cent	5½
Argyrol, 40 per cent	7½

After prolonged treatment with one antiseptic with no apparent effect, a change to another drug will frequently clear up the discharge in a relatively short time and render the secretions gonococcus-free.

A weak, saline douche seems more satisfactory than either potassium permanganate, lactic acid, or plain water. Our experience suggests that in addition to reducing the local inflammation and the discharge, such a douche is of some value in shortening the course of the disease.

At one time, thinking that perhaps gonorrhea was after all a strictly self-limiting disease, we observed several cases for some weeks without any treatment other than ordinary cleanliness. There was, under such conditions, no apparent improvement in the local condition and the discharge continued to show gonococci.

No consistent relation was found between the duration of the disease and its response to treatment, although in general the more recent infections required a longer time for complete disappearance of the organisms from the secretions.

We have not as yet given vaccines a satisfactory trial, but the reports in the literature are very contradictory, Hamilton,<sup>12</sup> Condat,<sup>13</sup> and Blanco and Villazon<sup>14</sup> reporting good results, while Barnett<sup>15</sup> could detect no definite improvement when vaccines were relied upon. We have tried "Gonalin," a commercial preparation of killed gonococci, with no noteworthy results.

#### STANDARDS OF CURE

It is practically impossible to state whether a patient is cured, since recurrences are so common. We have arbitrarily adopted, as a working standard, three consecutive weekly smears during which time treatment is continued, followed by a week of observation without treatment. If at the end of this period, the smears are still negative, the patient is discharged as "noninfectious" but the parents are instructed to have gynecologic and smear examinations made at the end of six weeks, six months, and one year.

#### RECURRENCES

Valentine<sup>16</sup> suggests that relapse occurs in almost all cases, while Fraser<sup>9</sup> states that only three of his cases relapsed, although three

others did not benefit from the treatment, and Norris and Mickelberg<sup>17</sup> give the frequency of recurrences as 12 per cent. The incidence of relapse will undoubtedly vary with the standard of cure. In our 42 cases with observations varying from three months to two years, there were 7 patients who had relapses (16 per cent). Of these 7, one had three and another two recurrences, making our total incidence of relapse 23 per cent. In certain instances, so-called relapses are really reinfections, but in the majority this factor can be well eliminated and a diagnosis of true recurrence must be made.

#### PERIOD OF HOSPITALIZATION

In this series, and with the various methods of treatment used, the average time necessary for smears to become negative was four weeks (longest, seventeen weeks; and shortest, one week), and the average number of days in the hospital after the smears were negative and before the patient was discharged according to our standards of probable cure, was thirty-four days. This made the average period of hospitalization about nine weeks.

#### SIMILARITY TO GONORRHEA IN ADULT FEMALES

Pearce,<sup>18</sup> by immunologic tests, attempted to divide the gonococcus group of organisms into infantile and adult types, assuming the former to be the causative organisms in vulvovaginitis. Clinically, such a differentiation has never been supported since many of the cases are acquired from adult members of the family, and to assume that the organism causing the vulvovaginitis is different from the organism causing gonorrhea in the adult, from whom it was acquired, seems unreasonable. Torrey and Buckell<sup>19</sup> have concluded from more recent serologic studies that "cross absorption experiments indicate that no definite serologic distinction may be drawn between strains isolated from vulvovaginitis cases and those from gonococcus infections in adults."

Our experience indicates that the only real differences between the disease in infants and in adults are the mode of acquiring the infection and the frequency of urethritis and salpingitis. We know of no definite reason for the relative infrequency of urethritis, although it is interesting that none of our very young children had organisms in the urethra, the youngest being six years of age. The small, undeveloped labia, the absence of pubic hair, and the young type of epithelium are the usual explanations for the ease with which the disease may be acquired by children; while the relative infrequency of salpingitis can surely be explained by the absence of menstruation, since the upward spread of the infection in adults most frequently occurs in association with that function.

The results of treatment are hardly more satisfactory in the adult female than in the child, even though here we may resort to the use

of the electric cautery and diathermy, methods which are not recommended in children. The problem of recurrence is similar, although in the adult it becomes increasingly difficult to rule out reinfection.

We are, therefore, forced to conclude that there is a marked similarity between the disease in the infant and in the adult, and suggest that the disease is better described by the term gonococcus infection in female children rather than gonococcus vulvovaginitis, which does not describe the full extent of the pathologic involvement.

#### SUMMARY

Contamination from some member of the family was, in this series, the most frequent source of gonococcus infection in female children, although in the majority of cases no etiologic history could be obtained.

The most reliable method of diagnosis consists in a correlation between the clinical findings and the results of a Gram stain of the secretions.

Smears from the cervical canal were positive for the gonococcus in 40 of 42 cases.

There was no definite relation between the duration of the infection and the cervical involvement. Even in recent cases gonococci were found in the cervix.

Gonococci were obtained from the urethra in nine cases, or 21 per cent, but never in children under six years of age.

Mercurochrome (5 per cent) caused the organisms to disappear from the secretions more quickly than either 2 per cent mercurochrome solution, 2 per cent mercurochrome ointment, or 40 per cent argyrol.

Four weeks was the average time necessary to procure negative smears.

Relapse occurred in approximately 23 per cent of the cases.

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# PRESERVATION OF OVARY BY MEANS OF INTRAUTERINE TRANSPLANTATION IN RADICAL OPERATIONS FOR ADNEXAL DISEASE\*

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IN NO other field of surgery is function so light-heartedly sacrificed and with such disastrous results as in the inflammatory diseases of the female generative organs. The gynecologists of the past and a good many of the present day still cling to the old formula of making "a clean sweep" in gonorrheal and other forms of inflammation of tubes and ovaries. The abrupt climacteric disturbances are obvious, but who can follow the more subtle effects of loss of ovarian function, the break in the balance of endocrine secretions and of premature senility? We shudder to think that the price of gonorrheal infection in the male would be castration.

The trend of modern surgery is distinctly toward preservation of function. We are not so much concerned with our ability to remove an organ, as with the question of how the function of the organism will be affected thereby.

Attempts at preservation of ovarian function in mutilating operations upon female generative organs have occupied the minds of gynecologists for some time. An admirable review of the literature on the subject was presented by Dr. F. H. Martin.<sup>1</sup> Pieces of ovary were transplanted into the anterior sheaths of the rectus muscle, into the space between its posterior sheath and the peritoneum, and into the broad ligament, in these cases. Ovarian function could be preserved for variable periods of time. The first attempt to preserve the possibility of pregnancy was made by Robert Morris<sup>2</sup> in 1895. He implanted the healthy portion of a supposedly diseased ovary into the interior of the stump of one oviduct, after radical removal of both tubes and ovaries. The patient became pregnant one month later but aborted at the end of two months.

The report of individual cases and of small series by different authors may be omitted, as this work has already been done by W. L. Estes, Jr.,<sup>3, 4</sup> by Marian Douglas and others. I shall call your attention here to two fairly large series, that of W. L. Estes of Bethlehem, Pennsylvania, and of Theophile Tuffier of Paris.

Briefly, the technic employed by W. L. Estes, Sr., and Jr., is as follows: "The tube of the implanted site is removed, together with enough of the horn of the uterus at the tubal attachment to leave a raw area the size of the cut surface of the ovary. In the center of this surface will be seen the opening into the uterine cavity less than one-quarter of a centimeter in diameter. A longitudinal slice is

\*From the services of the Cook County and Wesley Memorial Hospitals.  
Read before the Chicago Gynecological Society, February 18, 1928.

taken through the full diameter of the ovary, removing usually about one-quarter of it from the surface opposite its ligament and mesentery. The amount of ovary removed depends upon the amount of cystic degeneration or inflammation that may be present. The cut surface of the ovary is then turned over upon the denuded area of the uterine horn and sutured in place by a continuous catgut suture. The round ligament is then plicated over this entire area by suture to the uterus, to cover and completely peritonealize it." By this technic they have operated upon one hundred patients, but were able to follow up only twenty-seven of these. Pregnancy occurred in four, or fifteen per cent. Two patients aborted at about the third month while two went on to full term. The full-term children are living and normal. Menses were regular in nineteen, irregular in four. One patient only failed to menstruate. Three had to be reoperated upon because of discomfort, pain, and disability. A cystic enlargement of the implanted ovary was found in two. Estes makes this conclusion: "If pregnancy occurs after implantation, it must be because the surface of a graafian follicle comes in contact with the opening of the tube and heals in this position, so that when the follicle ruptures, the ovum can enter the uterus. Therefore, as the graafian follicles are in the cortex, a higher percentage of pregnancies may follow the operation, if care is taken to remove either a thin layer of the surface or fully seven-eighths of the entire ovary, so that ovary is sectioned through the cortex and a cut section of cortex with follicles is implanted upon the uterus and tubal opening."

Tuffier's<sup>5, 6</sup> series includes twenty-nine observed cases. His method of operating was as follows: The uterine cavity is dilated by means of tents, twenty-four hours before the operation. He makes a lateral posterior incision through the uterine wall, into the cavity, and introduces the ovary into the uterus so that its head is in the cavity and its neck is in the uterine musculature. In that way the ovary is prevented from hanging like a polyp. He did not have a single mortality. Results were excellent in twenty-one cases. None of his cases became pregnant. He mentions, however Petit's case in which the woman became pregnant and was delivered at full term. As a result of his experience Tuffier states that transposition of the ovary, with or without the pedicle, exerted a very favorable action upon the general condition of the women. Menses appeared from three to five months after operation and persisted for periods varying from five to ten years, in some without a break. The operation may be followed by pregnancy with normal birth. The only complication noted was mild pain, preceding menstruation, in about fifty per cent of cases.

Marion Douglas<sup>7</sup> had one pregnancy in a series of four cases. This pregnancy terminated at the tenth week. The case of W. S. Bainbridge<sup>8</sup> is quite interesting. He operated in 1905, upon a patient with severe suppurative condition of both tubes and ovaries. He implanted a small piece of ovary into the uterine horn. Four months later the patient menstruated and one and one-half years later she was delivered of a normal, full-term child. A year later the husband died. Menstrual life was quite regular and normal. Menopause took place at fifty-one years, twelve years after the operation.

I wish now to present a series of sixteen patients operated upon by myself at the Wesley Memorial and the Cook County Hospitals. In a group of eleven cases a free transplant of a piece of ovary was made into the uterine horn. In the second group of five cases, the ovary was transplanted into the uterine horn according to the method of Estes with its vascular pedicle preserved. Operations were performed for inflammatory and suppurative diseases of tubes and ovaries. Follow-up study was very difficult because of the nature of the mate-

rial. All eleven women began to menstruate six weeks to three months after the operation. No pregnancy occurred. Two had positive Wassermann reactions. Miscarriages were common in the previous history. The only complication noted was slight premenstrual cramps in certain cases which were followed for from six months to two years. Menstruation continued uninterrupted in all.

In the second group of cases, five women were operated upon. In all five, menstruation began three weeks to two months after the operation. One became pregnant. Her history is as follows: In the early part of 1924, the patient had had the appendix removed and both tubes ligated because she did not wish children. She was now desirous of pregnancy. The right ovary was implanted into the uterine horn. She menstruated two months later and every month thereafter. She did not have any pain and the amount of flow was about normal. She presented herself for examination nine months later, stating that she had missed the last two periods. Examination showed the uterus enlarged to about the size of a two months' pregnancy; there was marked tenderness in the region of the right ovary. Two days later she began to flow, and four days later she expelled uterine contents which on examination, proved to be a product of a two months' conception. Menstruation commenced one month later and continued regularly.

#### SUMMARY

The type of cases which come to the service of Cook County Hospital makes "a follow-up" exceedingly difficult for a period sufficiently long. Frequency of syphilis makes the possibility of pregnancy rather remote. Of sixteen cases of transplantation all resumed menstrual function from three weeks to three months after the operation. Slight dysmenorrhea was the only complication noted in some of the cases. Out of a group of five cases of transplantation with preservation of the pedicle, all menstruated and one became pregnant six months later, but aborted at two months. The effect of operation upon the health and the psychic states of the women was most gratifying. My experience coincides with that of Estes and Tuffier. Preservation of ovarian function in these cases is a distinct advance over the older castrating procedures.

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## VAGINAL DISCHARGE DUE TO TRICHOMONAS VAGINALIS\*

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IN CERTAIN patients with a persistent vaginal discharge which is very difficult to cure, smears made of the vaginal and cervical discharge (and urethral if any is present) fail to detect the causative organism. When gonococci are found, they are usually assumed to be responsible for the discharge. In many instances, no pathogenic organism is found on stained slides. The organism known as the *Trichomonas vaginalis*, which is a parasitic, flagellated, protozoon and causes a characteristic vaginal discharge to be described in this paper, is nearly always overlooked because it is impossible to detect in stained preparations unless one has special information concerning its characteristics. It is, however, very easily found in a hanging drop. Unfortunately a hanging drop examination is seldom made of a vaginal discharge although such an examination should be a routine one as a preliminary to the treatment of every discharge.

The *Trichomonas vaginalis* was first described by Donn  in 1837. Hausmann in 1870 reported that he had found this organism in the vaginas of 37 per cent of pregnant and in 40 per cent of nonpregnant women. The most important clinical work on this protozoon was done by Hoehne, who at the time of his report in 1916 had treated more than 100 patients. In a large series of routine examinations of vaginal secretions and discharges, Hoehne found the organism in 34 per cent of pregnant and in 28 per cent of nonpregnant women, but in most cases the number of organisms was small. Reuling found the parasite in 18.4 per cent of women, and Schmid and Kamniker in 69.9 per cent. All these reports came from Germany but the organism has been found in other parts of the world as evidenced by the fact that Ponoschina found it in 30 per cent of adult women in Russia, Brumpt observed it in 10 per cent of women in a Parisian gynecologic clinic, and Hegner found it in 50 per cent of 32 women examined in Honduras and Costa Rica.

The pathogenicity of the *Trichomonas vaginalis* has not been definitely proved, hence, the matter is still one of dispute. Hoehne, like Donn , Hausmann and K lliker and Scanzoni, found that the trichomonas was present only in women in whom the vaginal secretion was abnormal. In most instances there was an excessive number of leucocytes. Marchand and also Arnold says the organism does not cause disease but it exists on a pathologically changed vaginal mucosa. Hoehne, Gragert, Liss, Traugott, Littauer, Schmid and Kamniker and A. Seitz claim that the organism is distinctly pathogenic in many cases, whereas L ser, Wolfring, F th, Neumann, Mayer and Seeliger maintain that the parasite is harmless.

In the vaginas of pregnant women Hausmann found this flagellate in 37 per cent, Hoehne in 34 per cent, Schmid and Kamniker in 24.4 per cent, Seitz in 20

\*Read before the Chicago Gynecological Society, February 18, 1928.

per cent and Liss in 19.5 per cent. Nearly all of Schmid and Kamniker's patients had fever in the puerperium, especially those who had had lacerations or operative deliveries. Hence, according to these authors, the presence of trichomonas during pregnancy forbodes a febrile puerperium. Gragert as well as Liss came to the same conclusion and urges treatment during pregnancy and the avoidance of internal examinations and manipulations during labor.

The origin of the *Trichomonas vaginalis* is unsettled. A trichomonas organism is frequently encountered in the mouth and in the feces of normal persons. Bensen, and also Webster, believes the *Trichomonas vaginalis* is identical with the trichomonas found in the mouth and in the intestines. Lynch, however, says these three organisms have not been certainly identified as the same.

The best way to study the organism is by means of hanging drop preparations, or by diluting a drop of vaginal secretion with a drop

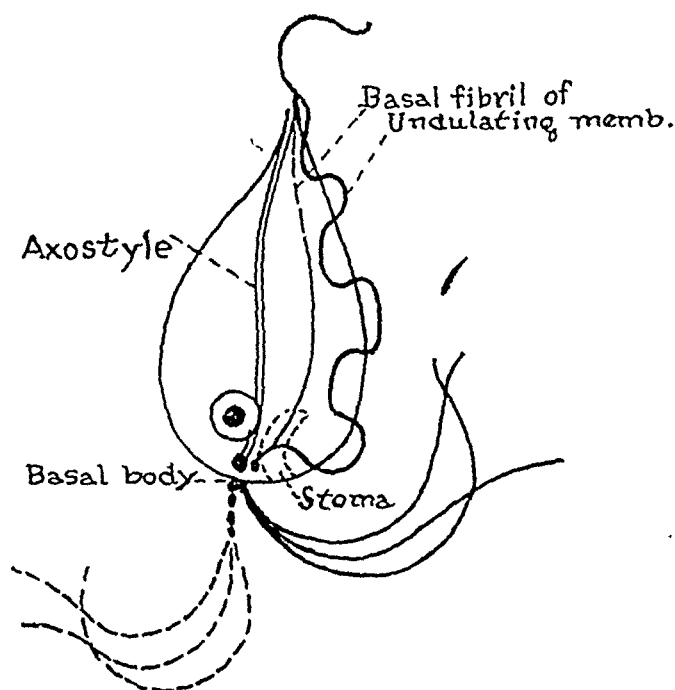


Fig. 1.—Shows essential structures of the *Trichomonas vaginalis*. (From Rodenwaldt.)

of normal salt solution or Ringer's solution on an ordinary glass slide. The drop of secretion may be obtained with a platinum loop from the vault of the vagina after exposure with a speculum. A more simple method is to make a vaginal examination and on withdrawal, a moderate amount of secretion will be found adherent to the gloved fingers. One or more drops may easily be placed on cover slips or slides. If the latter method is used and the glove is dry when drawn on, the dusting powder should be washed off with soap and water before making the vaginal examination. No antiseptic or lubricant should be used on the glove. For studying the organism, fields should be selected where there is relatively little discharge, namely, at the periphery of the drop of secretion. The drop usually consists of a large number of leucocytes and bacteria, many epithelial cells and

many trichomonas. With the ordinary high power lenses the parasites may be readily seen because of their motility.

The *Trichomonas vaginalis* varies considerably in size. Usually, however, it is larger than a polymorphonuclear leucocyte, but smaller than an epithelial cell. The measurements given by various individuals are as follows: Rodenwaldt, length 12 to 30  $\mu$ , width 8 to 18  $\mu$ ; V. Prowazek, length 12 to 30  $\mu$ , width 10 to 15  $\mu$ ; Hegner, length 7 to 21  $\mu$ , width 6 to 18  $\mu$ ; Bensen, length 16 to 26  $\mu$ , width 6 to 18  $\mu$ ; and Reuling, length 10 to 30  $\mu$ , width 10 to 15  $\mu$ . The organism varies in shape also. Usually, however, it is spindle shaped or pyriform. (Figs. 1, 2, 3, and 4. The front end is rounded and from it protrude

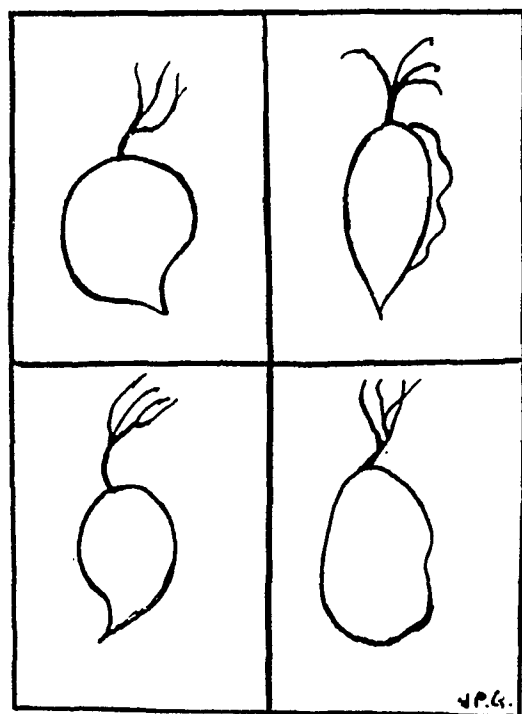


Fig. 2.—Simple outline drawings of trichomonas. All the organisms have four flagella, and one shows the undulating membrane.

four flagella which arise from a common stem. The older writers believed there were only 3 flagella, but Reuling in 1921 definitely proved there were four. The flagella arise in pairs, are approximately of the same length, and are more than half as long as the body of the organism. The point of origin of the flagella is a group of large, dark blepharoplastic granules and at this site the capsule is retracted. Starting from another dark granule near the base of the flagella, an undulating membrane runs somewhat spirally along the entire body to the posterior end which is usually pointed. Between the origin of the flagella and the undulating membrane is a light tubular organ. The protoplasm of the organism is not homogeneous but consists of

myriads of fine granules. Throughout the cytoplasm are small vacuole-like areas which are irregular in number and shape and show a distinct fat reaction with Sudan III. The nucleus of the trichomonas is usually eccentrically situated near the base of the flagella and is oval or pyriform in shape. In the fresh hanging drop preparation the parasite is in constant motion. The movement of the flagella is somewhat similar to that of a fishing line when cast. The flagella first strike sideways, then they undergo a circular movement toward the middle and finally the free ends turn inward. By means of this motion the flagella force bacteria, cellular detritus, and fat droplets toward the tubular organ where they disappear, hence this is most likely the

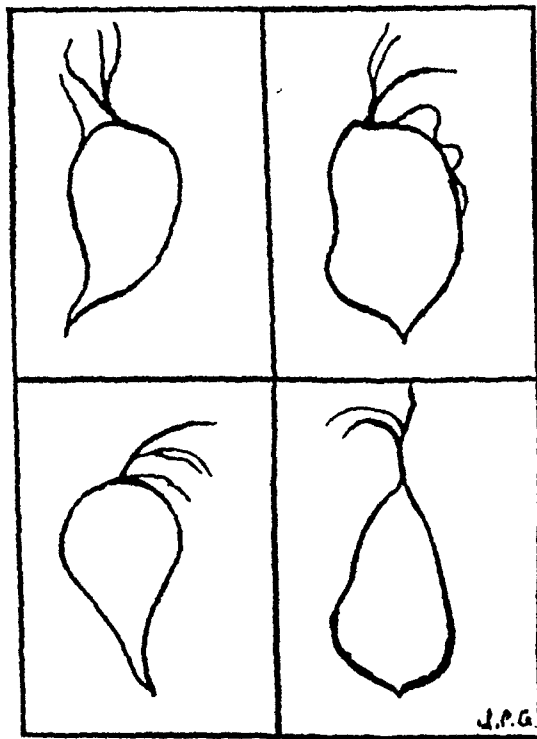


Fig. 3.—Two organisms in this group have only three flagella and one shows an undulating membrane.

mouth. The locomotion of the organism is independent of the flagella but is dependent upon the undulating membrane which is always found on the side where it can move freely. Occasionally, however, locomotion takes place by extrusion of pseudopodia and ameboid activity. Pseudopods are also extruded for purposes of phagocytosis of leucocytes and bacteria. Notwithstanding what some authors say, detection of the trichomonas in stained smears is easy to one who is familiar with these flagellates. The Gram stain is the one of choice and the best results are obtained if the contrast solution is permitted to remain on the slide a little longer than is customary. The organism may also be stained with Heidenhain's iron hematoxylin after moist fixation with bichloride alcohol (Schmid and Kamniker) or fixation

with Schaudinn solution (Hegner). For making slides, the discharge which is high up in the vault and close to the vaginal wall should be used and not the discharge which is on the surface.

Cultures of *Trichomonas vaginalis* are hard to make but good media are blood serum diluted with sodium chloride, Locke's or Ringer's solution (Lynch), half ascitic fluid and half Ringer's solution (Ohira and Noguchi), sodium-chloride-serum water (Hoague) and ten parts of nephritic urine to one part of blood serum (Schmid and Kamniker).

The *Trichomonas vaginalis* nearly always lives in symbiosis with other organisms, usually bacteria and most often the latter are gram-negative cocci which are smaller than gonococci. In most cases the

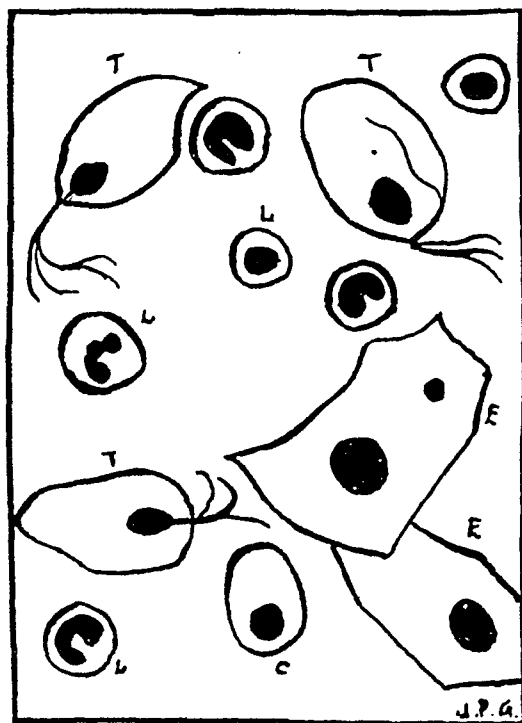


Fig. 4.—Gram stain. *T*, trichomonas; *C*, cyst form of trichomonas; *E*, epithelial cell; *L*, leucocyte.

bacterium found is the micrococcus *aerogenes alcaligenes*. The gas bubbles which are present in the vaginal discharge of many cases are produced by these micrococci according to Schröder, Löser, Schmid and Kamniker. The association of the gonococcus and trichomonas is very rare.

Without any special precautions the trichomonas can be kept alive at room temperature for three or four hours. Attempts made by Hoague to inoculate cats, kittens, and rabbits with trichomonas were unsuccessful. Likewise Blochmann failed to inoculate rabbits and Dock could not transplant the organism in guinea pigs, rabbits, and dogs. However, Kessel recently experimentally established *Trichomonas hominis* from man in ten of fourteen kittens.

## CLINICAL COURSE

The clinical picture produced by the *Trichomonas vaginalis* when it is pathogenic is rather uniform and striking. The patients complain of a profuse discharge which in about half the cases is associated with a burning or itching sensation in the vagina and on the vulva. In some cases the irritation is so severe that sleep is disturbed. The patients often scratch the external genitalia and an inflammatory reaction similar to intertrigo may result. Often the discharge has a very disagreeable and penetrating odor.

On external examination small condylomas either flat or pointed, may occasionally be seen but the introitus is usually reddened. The entire vaginal mucosa all the way up to the vault is found to be reddened and sometimes it is fiery red. In the introitus the redness is usually diffuse but in the vagina it may be diffuse or patchy. Often the vaginal mucosa has a deep orange color, and usually it presents the appearance of an inflammatory condition. For this reason the clinical picture is called *Trichomonas vaginalis* vaginitis. The region of the external os is also usually red and it occasionally bleeds readily even though there is no erosion. No inflammatory condition, however, is found above the external os. The vagina contains a very large amount of greenish, yellow, foamy pus which looks like gonorrheal pus; but sometimes the discharge is thin and watery. Most of it is found in the vaginal vault and it may have an acid, alkaline or amphoteric reaction. Some patients are nervous due to the constant irritation, sleeplessness and fear of having contracted a venereal disease. Many go from doctor to doctor and while they secure temporary relief, they are not cured. Quite a few women are unclean in their personal habits but by no means all.

## TREATMENT

Hoehne advocated the following treatment which others have used with slight modifications. The vagina is thoroughly washed with a 1 per cent solution of bichloride of mercury and dried and the vaginal wall is covered with glycerin which contains either borax or soda. The vestibule and labial folds are likewise treated. This treatment is repeated daily for four days or four times in one week. However, to maintain the cure, the glycerin mixture must be used daily for a while, then every second day and so on, gradually increasing the intervals between treatments. Hoehne prescribed capsules which contained 10 per cent borax or soda in glycerin so the patients could treat themselves after the first course of four treatments. Schmid and Kamniker treated 81 patients in this manner and obtained cures in 80.3 per cent. Recurrences were reported in 21 per cent. In 1919

DeLee advocated putting the patient to bed for two days during which time she received the following treatment. On the first day the vagina and vulva are scrubbed vigorously with green soap and water, using a rough cloth. The soap is rinsed out with sterile, distilled water. Then a 1-1500 bichloride of mercury douche is given and this is also washed out with sterile, distilled water. The next morning the vagina is again scrubbed with green soap and water and it is packed with cotton soaked with 4 parts of glycerin and 1 part of sodium bicarbonate. The following morning the tampon is removed and a sterile water douche is given. Baking soda douches are then prescribed twice daily.

The treatment I used in the present series of cases is as follows: The vagina is very thoroughly scrubbed with gauze saturated with tincture of green soap. All the vaginal folds are smoothed out and every part of the mucosa is scrubbed. The vulva is likewise scrubbed and the region around the anus. This scrubbing is one of the most important steps in the treatment and it is usually persisted in until very slight bleeding is noted in the vaginal mucosa. The soap is washed out with water and then the vagina is thoroughly dried. A tampon which is saturated with a methylene blue solution is inserted through a speculum high up into the vaginal vault. A second dry tampon is inserted to prevent the escape of the solution onto the patient's clothes. The vulva is lightly painted with the methylene blue solution. The patient is instructed to remove the tampons in the evening before going to bed. The string of the second tampon has a knot tied in it so the patient may know that this tampon is to be pulled out first. Because the methylene blue solution stains everything and can hardly be removed, the patient is advised to undress completely before removing the tampons and this is preferably done while in a bathtub. After removal of the tampons a douche containing 0.5 per cent lactic acid is taken. The treatment outlined is repeated every second day for three or more times. The patient takes a lactic acid douche on the mornings between treatments but not on the mornings she is to receive a treatment. No douche is taken on the morning of a treatment because we wish to see how much discharge there is and we also make hanging drop examinations. If the hanging drop on two successive visits fails to show trichomonas no further methylene blue treatments are given. However, the patient is advised to take a lactic acid douche daily for about two weeks. The purpose of the lactic acid douche is to attempt the reestablishment of a normal bacterial flora in the vagina. A matter of importance but unpleasant to discuss is the cleansing of the anus after a bowel movement. Most women use an upward sweep toward the vagina but this may produce reinfection if the causative organisms come from

the rectum. The patients are instructed to use a sweeping motion directed away from the vagina and toward the sacrum.

The formula for the methylene blue solution we use is as follows:

*Stock Solution*

Methylene blue crystals	1 ounce
Distilled water	10 ounces

*Solution Ready for Use*

Stock solution	25 c.c.
Glycerine	64 c.c.
Distilled water q. s. ad	1000 c.c.

RESULTS IN 56 CASES

I have treated 56 private patients by the green soap-methylene blue-glycerine-lactic acid method outlined above. All of these sought advice and treatment for a persistent, irritating, or obnoxious vaginal discharge.

The age of the patients is given in Table I. The youngest was twenty and the oldest fifty-one years of age.

TABLE I. AGE

20 to 25 years	11
26 to 30 years	22
31 to 35 years	12
36 to 40 years	6
41 to 45 years	3
46 to 50 years	1
51 years	1
	<hr/>
	56

The parity is listed in Table II and it will be noted that 32.7 per cent of the patients had never been pregnant and that 21.4 per cent had had miscarriages before being treated for their vaginal discharge.

TABLE II. PARITY

Nullipara	19
Primipara	22
Secundipara	11
Tertipara	3
Sextipara	1
	<hr/>
	56

The number of treatments is shown in Table III. The patient who received one treatment did not return for more. Most of the patients received two, three, or four treatments and I believe now that all patients should receive at least three. The recurrences were more easily cured because in 5 cases out of 14 only 1, and in 4 cases only 2 treatments sufficed. Two patients received the therapy suggested by Dr. DeLee after having been treated by the aforementioned scheme.



One of these patients was cured but one is listed among the failures. Some recurrences are perhaps due to persistence of the cyst forms of the trichomonas as described by Bensen.

TABLE III. NUMBER OF TREATMENTS

	FIRST COURSE	RECURRENCES
1	1	5
2	11	4
3	26	4
4	12	.
5	5	
6	1	1
	<hr/> 56	<hr/> 14

Table IV shows the time of recurrence in the ten patients who had a total of 14 recurrences. Three patients had a second and one patient a third recurrence. The time of recurrence varied from one to fifteen months.

TABLE IV. TIME OF RECURRENCE

	FIRST	SECOND	THIRD
1 month	1		
3 months	4	1	1
4 months	2	1	
5 months	1		
8 months	1		
11 months	0	1	
15 months	1		
	<hr/> 10	<hr/> 3	<hr/> 1

In Table V the results of the treatment are shown. Of the 48 patients followed up 38 (79.2 per cent) were cured after one series, and 5 (10.4 per cent) after repeated series of treatments. The total number of cures was therefore 43 (89.6 per cent). In the patients who were cured, it was noted that the amount of discharge, the number of pus cells and the number of trichomonas ran parallel. When the parasites were destroyed, the character of the discharge changed, the amount decreased to practically normal, the inflammatory changes in the vaginal wall disappeared and the subjective symptoms vanished. There were five failures (10.4 per cent) and all of these women are high-strung, sensitive individuals. Their constitutional make-up evidently plays a part in the persistence of the vaginal discharge, because in four of these cases the discharge is troublesome only when the women are mentally upset.

TABLE V. RESULTS

Number of patients followed up	48 out of 56 (85.7 per cent)
Number cured after one series of treatments	38 out of 48 (79.2 per cent)
Number cured after repeated series of treatments	5 out of 48 (10.4 per cent)
Total number of cures	43 out of 48 (89.6 per cent)
Number of failures	5 out of 48 (10.4 per cent)

Table VI shows the duration of cure which varies from two to forty-eight months. Some of the patients listed as cures for the first twelve months may have recurrences in the future.

TABLE VI. DURATION OF CURES

2 months	2
3 months	1
6 months	2
8 months	3
10 months	2
11 months	2
12 months	1
13 to 18 months	6
19 to 24 months	9
25 to 30 months	5
31 to 36 months	2
37 to 42 months	5
43 to 48 months	3
	<hr/>
	43

Among the 56 patients in this series there were eight whom I treated during pregnancy. The treatments were not as vigorous as in the nonpregnant women but they probably helped to prevent morbidity during the puerperium. As mentioned before, Gragert, Liss, Schmid and Kamniker reported that most women who have a *Trichomonas vaginalis* discharge during pregnancy have fever during the puerperium. Seven of my patients went to term and delivered as follows: spontaneous 3, low forceps 3, and cesarean section 1. The puerperium in these seven women was entirely uneventful. The eighth patient had a spontaneous miscarriage which was not followed by any complications. In addition, two women who were cured five months and twenty months ago respectively, are now pregnant and thus far the discharge has not returned.

In 19 cases after the vaginal discharge had been freed of *trichomonas*, the cervix was treated with the electric cautery because of a pathologic condition. In two additional cases the cervix had been cauterized before the *Trichomonas vaginalis* discharge appeared. In this series of 21 patients treated with the cautery, eight patients (33.3 per cent) are listed in the group of recurrences of the *trichomonas* discharge. Three of the five failures were in this group of patients.

On six patients after clearing up the vaginal discharge, I performed a Rubin tubal patency test without any complication. The tubes were found to be patent in four and closed in two cases. From one patient I removed a Bartholin gland cyst without any complications. In three patients, *trichomonas* were found in the urine but the patients had no urinary symptoms. Systematic examination of the urine would probably have yielded a larger number of such findings.

## SUMMARY

This report deals with 56 patients who complained of a persistent, irritating, foul, vaginal discharge, the cause of which was the *Trichomonas vaginalis*. Among 48 patients followed up, 89.6 per cent were cured after one or more series of treatments. The duration of the cure varies from two to forty-eight months. Failures were encountered in 10.4 per cent. While the results are fairly good, other forms of treatment are being studied in an attempt to help those patients who do not yield to the green soap-methylene blue-glycerine-lactic acid treatment. The point to be especially emphasized is that when a patient complains of a persistent, itching or burning, vaginal discharge which is yellow-green and bubbly and the vaginal mucosa is reddened, the diagnosis of *Trichomonas vaginalis* vaginitis can be made with great probability. To make the diagnosis certain, the simplest procedure is to examine a drop of the fresh discharge either as a hanging drop or on a flat slide.

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(For discussion, see page 897.)

## CHOREA GRAVIDARUM\*

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SINCE prenatal care has become an important part of the service rendered to the patient, the various complications of the gravid state have received more serious consideration.

It is my purpose to consider chorea gravidarum (which in its major form is one of the rarer diseases associated with pregnancy) because of its serious possibilities, and because in a review of the literature covering a period of twenty-five years, I have found that conceptions concerning its etiology, histopathology and treatment have undergone considerable modifications.

Chorea is such a rare complication of pregnancy that few individual practitioners have had a large personal experience with it, and many of the articles reviewed in the literature are simple recitals of case reports. Williams, in the latest edition of his textbook on Obstetrics, states he has seen only one grave case and that the patient died in spite of a premature spontaneous delivery.

The disease was first described by Schenkius in 1594 and by Horstius in 1660. As early as the latter half of the seventeenth century different authors called attention to the gravity of chorea in pregnant women. In 1869 Barnes collected fifty-six cases with seventeen deaths and noted that it was one of the most dangerous complications of pregnancy. He observed that patients will recover whether labor is induced or not, and that other patients die in spite of the interruption of the pregnancy.

With regard to the etiology of the disease there is a preponderance of evidence to support the belief that it is of infectious origin; that the usual seat of infection is in the brain and heart, with a predilection in the brain for the basal ganglia and in the heart for the endocardium, and more particularly the mitral valves. In cases autopsied, lesions of the endocardium have been found and Raymond, in addition to these, also found pathologic changes in the corpus callosum and the cerebrum. Raymond's observations on the suprarenals and the corpus luteum were negative, thus eliminating the part that these ductless glands were thought to have played in this complication of pregnancy.

LaPage suggested that lesions be looked for in the corpus striatum and in the optic thalamus in which lesions had been found in chorea.

Creutzfeldt, in 1924, reported a case in which he found lesions in the cerebrum, following the course of the vessels, the most severe degenerative processes being located in the striate body.

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Genova (1921) reported two cases of chorea gravidarum; both patients had rheumatism before the chorea, and after a review of the history of the disease and the theories as to its etiology, Genova stated that the most reasonable hypothesis is a toxico infectious origin of the disease.

Some observers believed that chorea gravidarum was a toxemia of pregnancy due to the absence of the menses and to toxins of fetal origin. It was suggested that it was due to defective elimination by the organism of toxins both exogenous and endogenous having a selectivity toward the nervous system and the joints. Choreic symptoms frequently occur toward the third month of pregnancy, favoring the theory that it is a toxemia.

While the theory of toxemia still has its adherents, it is my belief that careful autopsy examination will reveal in every case the presence of an infectious process. It is interesting to note, in this relation, that with one exception in my survey of the literature, no autopsy findings were recorded which showed changes found in the other fatal toxemias of pregnancies, viz., degeneration in liver, kidneys, heart muscle, etc.

Many observers have noted a neuropathic constitutional tendency as a predisposing factor to chorea, while a lesser number believe that heredity plays an important part. Some observers, such as Whitmore, have gone so far as to state that it is a pure neurosis. Exciting causes are traumatism, fright, and emotional conditions associated with hysteria. Neurotic mental symptoms frequently precede the attacks.

Flamma in 1919 reported a case of supposed chorea in which he feigned an interruption of pregnancy and found it to be a pure neurosis. This patient had lived with a choreic patient. Flamma and others warn against the interruption of pregnancy without evidence of a positive diagnosis of chorea.

Infections of known streptococcal origin, such as scarlet fever, rheumatic fever, and endocarditis often precede chorea gravidarum.

Fraipont reports fifty autopsies in which valvular lesions were found in 66 per cent.

The condition is more common in young women and more common in primiparae. It is also more common in those who have had previous attacks of chorea. It may or may not recur in later pregnancies. Martin reported a group of cases in which chorea was absent in the first and present in later pregnancies and we have observed two cases of chorea occurring during the second pregnancy.

The study of the choreic forms of lethargic encephalitis has added to the knowledge of the pathology of chorea. Marie and Tretiakoff examined the nervous system of a case of typical Saint Vitus dance in a child ten years old and found lesions in the neostriatum and central cortex similar to those of epidemic encephalitis. Evidence has accumulated to make it apparent that the pathologic basis of Syden-

ham's chorea may be a diffuse encephalitic process involving the cortex, pia, arachnoid, and the corpus striatum. The caudate and putamen are also affected.

The macroscopic changes are very slight and usually absent. This may account for negative autopsy reports in the literature and suggests the importance of microscopic examination of the brain in all fatal cases of chorea gravidarum.

Greenfield and Wolfson, reporting on the postmortem findings in a case of Sydenham's chorea, described in addition to a vegetative endocarditis, small, round cell, perivascular infiltration in the basal ganglia, and internal capsule similar to those of lethargic encephalitis except the white matter was more involved. They also found thrombi in the cortical vessels but they found no evidence of cerebral embolism, such as has been reported by others.

Lewy studied a series of cases in which the disease process was not confined to the corpus striatum; in addition to foci of cell degeneration in the neostriatum there was evidence of cell changes and fatty infiltration in the cortex. The foci in the striatum showed acute degeneration of the small ganglion cells, with ameboid transformation of the striae adjacent to the glial cells. These neuroglia changes were present in the acute forms.

The old theory that cerebral emboli were responsible for the disease is not supported by pathologic findings.

Marie, Bouttier and Trétiakoff recorded an observation of a very severe acute chorea in a twenty-one-year-old pregnant woman. The first indication of illness followed upon a short neurasthenic prodrome during the beginning of pregnancy. At the end of two months death followed. In the uterus was found an 8-mm. embryo. On histopathologic investigation they found in the cortex of the hemispheres and striatum nodules varying in size from very minute areas up to the size of a pin-head which consisted of perivascular glia proliferation with destruction of the adjacent nervous tissue.

Creutzfeldt, 1924, described a fatal case in which he made a histopathologic study, from which he concluded that the findings in the nervous system consisted in an inflammatory type of disease with hyaline degeneration which attacked both gray and white matter, the localization being dependent upon the course of the vessels. The more marked degenerative processes were found in the striate body where they involved particularly the smaller ganglion cells. He thought that the anatomical location of the lesions could be correlated with the location of the choreic movements. Lehozky-Semmelweis similarly observed in a fatal case which began during pregnancy with fever and arthritis, that in addition to parenchymatous degeneration of heart, liver, and kidneys, there was edema of the meninges and hyperemic spots in the basal ganglia. Microscopic investigation revealed perivascular infiltration in the striatum, thalamus, and substantia nigra. The cellular elements of the infiltration consisted chiefly of lymphocytes, but a few plasma cells were present and a few pigment-containing macrophages were found in the substantia nigra. There was necrosis of the nerve cells in the putamen and globus pallidum accompanied by glia proliferation.

The chief symptoms of chorea, whether occurring in the gravid or nongravid state, are involuntary and irregular purposeless movements of any or all of the muscles of the body. In severe cases the whole

body may be involved. Oppenheim, however, refers to rare cases of chorea where the movement is limited solely to the muscles of speech, eyes, lips, tongue, pharynx, and larynx. The intensity of the contractions varies and it is reasonable to assume that the violent uterine contractions occurring during chorea may be a frequent cause of premature expulsion of the fetus. The muscles of the hands, fingers, face, and tongue are most often affected but the legs and trunk muscles may also be involved. The patient may throw herself out of bed, bite her tongue, abrade her skin, or otherwise injure herself, which injuries may result in infection. The patient may become absolutely incompetent mentally, and in one of our patients it was necessary to place her in a restraining sheet both before and after emptying the uterus. Oppenheim used the term "muscular insanity" to describe the involuntary, irregular, and purposeless movements. In many cases the choreic movements cease during sleep but in the severer forms the movements are continuous and greatly aggravate the exhaustion, which is one of the causes of a fatal termination in chorea.

The most superficial examination is usually sufficient to establish a diagnosis of chorea gravidarum. Probably the most difficult task is to distinguish it from hysteria which can usually be differentiated from true chorea by the presence of other stigmas of hysteria and by the rhythmical character of the hysterical movements which are usually absent when the patient thinks she is not being observed. Flamma warns against the interruption of pregnancy in neurotic cases simulating true chorea, and we strongly recommend consultation with a neurologist in all cases of chorea gravidarum.

DeLee states that the maternal mortality in chorea gravidarum is from 20 to 30 per cent while the fetal mortality is 50 per cent. Other authorities estimate maternal mortality to run from 10 to 75 per cent. Backaus says that chorea in general is less serious for a child, more serious for a man, still more serious for a woman, and most serious for a pregnant woman. The fetal prognosis depends on the time when the fetus is expelled, on the severity of the choreiform contractions, the amount of asphyxiation of the fetus from heart lesions and other conditions in the mother, and upon the degree of septicemia of the mother. Muhlbaum stated that the predominance of psychic over motor delirium indicates an unfavorable prognosis. Royston concluded that pregnancy in a choreic individual is not necessarily serious although it may assume this character, but that an acute chorea beginning during pregnancy is always a grave affection. I believe that the high mortality, both maternal and fetal, consequent in severe chorea gravidarum, is not generally recognized by most physicians.

Concerning the treatment of chorea gravidarum there are two extreme schools, one in which the most radical treatment is recommended and the other in which the most conservative methods are advised.

LaPage strongly recommended emptying the uterus promptly in severe cases because he feels that the mortality in delayed cases is extremely high. In this opinion many authorities concur. I believe that chorea gravidarum is always of infectious origin and if we are correct in this assumption we are correct in assuming that the value of any medical treatment, with the exception of rest and quiet, is doubtful. Fletcher Shaw, Wall and Andrews, Croft, and others in England have reported a large number of cases successfully treated without the induction of premature labor.

Bonhoeffer states that over half of the cases of chorea gravidarum are harmless and result favorably, and we believe that this is, generally speaking, true. Muhlbaum has observed that most of the milder cases are treated by the neurologist and are not seen by the obstetrician. He further observed that an attack of chorea occurring first during pregnancy, accompanied by marked motor disturbances, forms an indication for the interruption of pregnancy. Hellier strongly advised terminating pregnancy in severe cases and stated the following indications for evacuation of the uterus: When there are violent movements in spite of rest in bed and sedatives; when there is inability to sleep or eat enough, accompanied by loss of weight; when the mental conditions are confused and when there is tendency to delirium; when there is a rise in temperature, a dry tongue, and especially, and he accentuates the following point: when the pulse is persistently above one hundred and is becoming weaker and more rapid.

Bumm, Martin and Anton recommended vaginal cesarean section as a rapid means of emptying the uterus in these cases. DeLee suggested abdominal cesarean section when the choreic gravid patient is at or near full term, and Jakoby reported a case delivered by cesarean section in December, 1925. Various medical treatments have been used, such as salvarsan (Hartel and others), arsenic, aspirin (Wall and Andrews), blood serum from a healthy pregnant woman (Albrecht), endocrine therapy (Haneborg), chloral, bromides and other sedatives, but it is our personal opinion that with the exception of sedatives in the cases of recovery in which these medicaments were used, the patients recovered in spite of, and not because of the treatment.

We desire to most strongly recommend absolute rest and quiet in all cases of chorea gravidarum, however mild or severe.

The following cases represent two distinct types of the disease, one being a severe form in which conservative treatment failed and the uterus was emptied by abdominal cesarean section.

CASE 1.—Mrs. E. D., aged twenty-six, married, secundipara, was admitted to Blodgett Memorial Hospital on August 1, 1925, complaining of continuous twitching and jerkings of the arms and legs. She first noticed an occasional twitching in the right arm about three weeks previous to admission which became worse and spread to the right leg and to the right side of the face. Four days before admission she had almost continuous jerkings. Her past history was negative for chorea and rheumatism. The patient had a tonsillectomy and adenoidectomy at the age of fifteen on account of repeated throat infections. With her previous pregnancy she had twitching of the right arm on the day of delivery, but this lasted only one day. Family history was negative.

On examination the patient was found to be about eight months pregnant. She



was of a tall, slender build with typical adenoid facies and protruding upper teeth. There were marked purposeless movements of the right upper extremity with picking at the bed clothes, and there was an occasional jerking movement of the right leg and irregular twitching of the facial muscles on the same side. These movements persisted during sleep. The patient exhibited mental confusion, was disoriented at times, and talked incoherently. The heart tones were clear, and no foci of infection were found. Blood pressure 110/72. The urine was negative for albumin and casts, the white blood count 4,750, blood Wassermann and spinal fluid Wassermann were negative. N.P.N. was normal and blood culture was negative on three successive days.

On the second day the mental symptoms became worse and she developed numerous hallucinations, chiefly auditory and on the basis of these, persecutory delusions. The choreic movements became more marked until the nurses were unable to keep her in bed without the use of a restraining sheet.

Treatment consisted in eliminative measures plus large doses of chloral and bromides which were augmented by the use of morphine and scopolamine, but her condition grew progressively worse until she became almost unmanageable. Therefore, on August 4 she was delivered by classic cesarean section of a living male infant weighing 6 pounds and 15 ounces. The child did not nurse well and presented two definite developmental anomalies, a facial asymmetry and a marked microphthalmus.

For the first few days postoperative, movements were marked and a restraining sheet was necessary, but movements decreased and the mother made a slow but for the greater part uninterrupted recovery. On August 8, she exhibited only slight twitching of the right arm, although she remained mentally confused. Gradual improvement continued and on the fourteenth day she was able to write. The patient left the hospital in good condition on August 30 and a letter from her dated July, 1926, states that both she and the baby are now in excellent health.

CASE 2.—Mrs. G. B., aged twenty-seven, married, housewife, secundipara, reported to the clinic on March 14, 1927, complaining of twitching over the entire body and salivation. This trouble began about March 1, 1927, following a period of nervous strain.

The patient has always been of nervous temperament and given to fits of laughing and crying. She was treated for chorea about one year ago. Tonsillectomy was performed in December, 1926, following which she felt well until about two weeks ago when she began to have symptoms as described. She has one child four years old; had kidney trouble during the pregnancy and convulsions (eclampsia) but no choreic movements. Menses began at fifteen, regular, twenty-eight-day type, lasting four days. Last period December 12, 1926.

The patient's mother had a nervous breakdown and also had twitchings of hands during pregnancy.

Examination showed a slender woman of evidently unstable nervous type, heart tones clear, B.P. 110/65. There was a slight relaxation of the vaginal outlet, bilateral laceration of the cervix with erosion of the anterior lip and a small polyp. Uterus was enlarged to size of three months' pregnancy, in good position, and otherwise negative. There were frequent twitchings of the hands, facial muscles, arms, and shoulders, and occasionally other parts of the body. A diagnosis of chorea in pregnancy was made and neurologic treatment advised. She was treated with bromides and rest and gradually improved although she continued to be nervous. Progress was then normal until July seventh, when she began to show a slight rise in blood pressure. Two days later a trace of albumin appeared in the urine. In spite of restricted diet the pressure continued at a level of about

140/110 with albumin in the urine, and on July twenty-seventh, casts were found. This condition persisted in approximately the same degree throughout the month of August. Near the end of the month slight edema appeared. On September third the pressure had risen to 150/100, and on the seventh to 180/120 when she began to have severe headache. At this time she was placed in the hospital, a milk diet prescribed and bromides and chloral administered per rectum. The next morning she complained of spots before the eyes and nausea. Blood pressure 178/110; eye grounds negative; N.P.N. 31. Some twitching of arms and eyelids noted. During the night she complained of stiffness of the right side of the face, and the nurse noticed that she talked through the left side of the mouth. The next morning she exhibited a right facial paralysis of the peripheral type. Blood pressure still elevated.

Under gas anesthesia a Voorhees bag was inserted at 11:30 A.M. The patient expelled the bag and gave birth to a 4 pound 10 ounce living male infant six hours later. Blood pressure 150/105 following delivery. Two days later the effects of the facial paralysis were marked. There were casts in the urine. The pressure returned to normal in the course of one week, but casts were still present and the condition of the facial muscles was unchanged. Then she began to have pain in the right side of the face and following this the paralysis gradually cleared. The infant gained rapidly and was in good condition on the date of discharge. There has been no recurrence of the choreic movements to date.

In each of the above cases several consultations were held with Dr. Frederick P. Currier, a neurologist, and there is no doubt as to the correctness of the diagnosis.

#### CONCLUSIONS

1. It is my opinion after reviewing the literature that all cases of chorea gravidarum are on an infectious basis and that accompanying lesions present in the endocardium and joints are of the same origin.
2. The pathologic changes consist of an inflammatory process located in the cerebrum, the most marked changes being in the basal ganglia.
3. Conservative treatment is sufficient for the mild and moderately severe cases, but the interruption of pregnancy must be resorted to in the extremely severe forms. Cesarean section may be performed when the child is at or near full term.
4. The dangerous possibilities of chorea gravidarum, both fetal and maternal, should be realized by all practitioners who do obstetric work.
5. Proper prenatal service with special reference to the removal of all foci of infection wherever practicable and with particular attention to the management of the neurotic patient from the standpoint of rest, both mental and physical, should reduce the incidence and severity of chorea gravidarum.

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\*Arranged in chronological order.

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(For discussion, see page 898.)

# BACILLUS PYOCYANEUS BACTEREMIA OF PLACENTAL ORIGIN

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ALTHOUGH the pyocyaneus bacillus has been found in pure culture in all parts of the body, in localized lesions and in general systemic infections, it is only infrequently isolated in pure culture from the blood during life.

Numerous reports have been published in the literature describing cases of supposed generalized pyocyaneus infections, but a goodly percentage of these cannot be considered authentic. The *Bacillus pyocyaneus*, like the colon bacillus, is actively motile and is a frequent antemortem and postmortem invader of the body; and a large group of cases which have been regarded, heretofore, as general blood stream infections due to the bacillus of green pus, fall into the category of those cases in which the organisms were isolated from the blood only immediately before death or from the organs at the autopsy table and, therefore, cannot be classed as genuine pyocyaneus septicemias. The only so-called generalized pyocyaneus infections which can be accepted as authentic are those in which the bacilli are found in the blood during life or when they are found in numbers in the organs postmortem and seem to stand in causative relation to the changes in these organs. True pyocyaneus sepsis is uncommon.

According to Peet,<sup>1</sup> the first bona fide instance of pyocyaneus septicemia diagnosed by blood culture during life was that of a three months old child, reported by Finkelstein<sup>2</sup> in 1896. A positive blood culture was obtained two days before death. Brill and Libman,<sup>3</sup> in 1899, reported the second case in the literature in which the *B. pyocyaneus* was found in the blood during life in such a way as to exclude all doubts. This case was the first on record in which such a finding had been made in an adult. A positive blood culture was demonstrated two days before the patient's death.

A number of investigators, among them Wassermann,<sup>4</sup> Kolle-Hetsch,<sup>5</sup> Fraenkel,<sup>6</sup> and others believed that pyocyaneus septicemias were brought about, in most instances, after some other organism had produced a lowered tissue resistance. Waite<sup>7</sup> maintained that, not infrequently, the bacillus pyocyaneus was the primary and sole cause of the infection. Freeman,<sup>8</sup> in a very adequate review of systemic pyocyaneus infections, stated that the disease occurred in two forms, the acute and the chronic, and that it was a serious malady, often resulting fatally, although recovery occasionally took place. Klieneberger<sup>9</sup> pointed out, on the other hand, that the pyocyaneus bacillus may be found in the blood in transient septic manifestations, that pyocyaneus bacteremias were not as rare as generally considered, and that the long accepted opinion that a pyocyaneus blood stream infection meant a hopeless prognosis or a protracted and severe illness, had to be revised.

The portals of entry of the *B. pyocyaneus* are usually the skin, the external mucous membranes, the linings of the respiratory system and the intestinal canal, infrequently the genitourinary tract, and very rarely the gravid or puerperal uterus. After a very extensive search through the literature, the number of cases found of puerperal sepsis due to the *Bacillus pyocyaneus* were very few.

In 1889, Charrin<sup>10</sup> published an admirable treatise, *La Maladie Pyocyanique*, and therein suggested for the first time that the uterine mucosa may be a portal of entry for the *Bacillus pyocyaneus* and described a case of puerperal fever, in which this bacillus was associated with a few streptococci.

Perkins,<sup>11</sup> in an investigation of nine cases of pyocyaneus infection, reported two in which he attributed the focus of infection to the uterine mucosa. In the first instance the patient ran a course simulating tuberculous meningitis for six weeks following an abortion. The patient died eventually and cultures obtained from the uterus and cerebrospinal exudate at autopsy, nineteen hours after death, revealed the *Bacillus pyocyaneus* and other organisms. Culture of the heart's blood was negative. The second patient died of puerperal sepsis six weeks postpartum. Cultures from the uterus and lungs after death grew the pyocyaneus bacillus. The heart's blood was sterile. Whether Perkins' cases can be considered unequivocally as puerperal pyocyaneus septicemias is problematic inasmuch as the cultures were taken after death and, therefore, are of questionable value.

Rolly's<sup>12</sup> report, on the other hand, is infinitely more convincing. He described a case of general septicemia in a woman, who, simultaneously with the onset of profuse vaginal bleeding, showed signs of sepsis and meningitis. On the fourth day of her illness pyocyaneus was obtained in pure culture from the blood, and again on the eighth and tenth days of her disease in increasing numbers. She died on the eleventh day and the same organism that was found in the blood stream was cultured from the heart's blood, kidneys, spleen, intestines, and other organs. The autopsy revealed that the patient had been gravid. It was believed that the vaginal bleeding was due to the interruption of the pregnancy, that the gravid uterus was the source of the infection in the absence of any other portal of entry, and that the case was one of pyocyaneus puerperal sepsis.

There has not been found recorded, heretofore, a single instance of a transient bacteremia due to the *Bacillus pyocyaneus* in which the gravid or puerperal uterus was the origin of the infection. The following two cases were suspicious of a postpartum pyocyaneus bacillemia, but actual proof was lacking.

The first, mentioned by Walthard,<sup>13</sup> concerns a thirty-five-year-old multipara, who, on the third day postpartum, developed a chill and a substantial rise in temperature. Culture of the lochia revealed the *Bacillus pyocyaneus* and other organisms. No mention is made of blood cultures ever having been taken. After appropriate treatment the temperature dropped to normal and the patient recovered.

Delmotte's<sup>14</sup> case is quite similar. He reported the findings in a primipara, aged eighteen, who was delivered spontaneously and there were no injuries. Two days later, the patient developed considerable fever. The *Bacillus pyocyaneus* and a staphylococcus were isolated from the lochia. Blood cultures were negative. The patient recov-

ered. It is not unreasonable to assume that a transient pyocyaneus bacteremia may have been present at some time or other in each of these cases. That blood cultures were not obtained at just the proper moments to prove that point is unfortunate.

The following case from the Gynecological Service of Mount Sinai Hospital is probably the first to be reported of a pyocyaneus bacteremia of placental origin:

Mrs. B. A., aged thirty-four, a multipara, was admitted to the hospital November 13, 1927. She complained of vaginal spotting of two weeks' duration and cramp-like abdominal pains for three days. The family history was inconsequential. The personal history was unimportant except for erysipelas ten years ago. The menses began at fourteen and were always regular. She had been married twelve years and had been gravid four times. She had had two uninduced abortions, each taking place in the third month of pregnancy. Her youngest child was eight years of age.

The last menstrual period occurred August 4, 1927. About November first, the patient began to spot per vaginam and several days later passed numerous blood clots. Ten days after the onset, she experienced rather severe abdominal cramps. The family doctor made a pelvic examination under aseptic precautions on November 13 and advised hospitalization. The patient denied strongly that any attempt had been made to interrupt the pregnancy. Her story seemed quite straightforward.

*Physical Examination.*—Temperature 99.6°, pulse 94. The patient was a plethoric, rather obese, and well-developed German woman. She did not look ill. No marked abnormalities were noted in the general examination. Blood pressure was 122/50.

*Pelvic Examination.*—Moderate amount of foul vaginal bleeding. Relaxed introitus. Small cystocele and rectocele. The cervix was violaceous, soft and closed. The fundus uteri was enlarged to the size of a three months' gravidity, forward, freely movable and irregularly contracted. The adnexa were negative. The parametrial regions were clear.

*Laboratory Examinations.*—Urinalysis showed a trace of albumin and numerous clumped white blood cells. Hemoglobin, 70 per cent (Sahli). Sedimentation time, thirty-one minutes. Blood Wassermann was negative.

*Clinical Course.*—Twelve hours after admission, the temperature rose abruptly to 105°, followed by a severe chill. Blood culture, at this time, was positive for a gram-negative bacillus in all of the following media: (1) tomato extract of liquid peptone and glucose; (2) 2 per cent glucose bouillon; (3) plain bouillon; (4) plain agar; (5) 2 per cent glucose-agar with 33 per cent ascitic fluid; (6) liver hormone-agar with 33 per cent ascitic fluid. The organism was identified as *Bacillus pyocyaneus*, 20 colonies per cubic centimeter of blood. Anaerobic culture (Noguchi-Rosenau cooked liver media) was negative.

The patient received 1¼ c.c. of pituitrin intramuscularly in divided doses. The fetus was expelled spontaneously about four hours after the medication. The placenta did not come away and it could not be expressed. Immediately after the expulsion of the fetus the temperature dropped acutely to normal and did not rise above 100° during the patient's remainder in the hospital.

In spite of large amounts of pituitrin and quinine, the placenta remained in the uterus. Four days later, during which time the temperature had been normal, it was decided to remove the placenta instrumentally. Without anesthesia the external os was exposed after having painted the vagina with a weak iodine solution. The cervix was neither grasped with a vulsellum forceps nor was its canal dilated.

An ovarian clamp was inserted gently into the uterine cavity and the foul-smelling contents were evacuated with ease. The wall of the uterus was not curetted. The material removed was cultured immediately. The *Bacillus pyocyaneus* and the colon bacillus were recovered. Microscopic examination of the uterine contents showed infected placental tissue. After an uneventful recovery, the patient was sent home November 29, 1927, the sixteenth hospital day.

There is no doubt that this is an authentic case of a transient *Bacillus pyocyaneus* bacteremia of placental origin. The evidence is fairly conclusive. The presence of the same organism both in the blood stream and in the placental tissue is more than merely coincidental.

#### SUMMARY

1. *Bacillus pyocyaneus* septicemias and bacteremias are uncommon.
2. Puerperal sepsis due to the *pyocyaneus* bacillus is extremely rare.
3. The case herein described is probably the first to be reported of a transient *Bacillus pyocyaneus* bacteremia of placental origin.

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BELLEVUE HOSPITAL.

## A SELF-RETAINING CANNULA FOR INJECTION OF LIQUIDS OR GAS IN TUBAL INSUFFLATION\*

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WHEN the use of iodized oils was introduced for roentgenographic study of the uterus and tubes, there came with it the need of an instilling cannula possessed of the following features:

1. It should have a metal shoulder firmly attached to the tip in order to prevent back leakage; the rubber urethral tips formerly used usually slide on the metal shaft when they become oily.

2. It should be self-retaining in the cervix as this eliminates further the risk of leakage; it also permits the patient to be moved for roent-

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genographic study or for operation (in cases in which the surgeon wishes to observe the fluid injected while performing laparotomy) without the disadvantage of requiring an attendant to hold the cannula in position. To retain the oil in the fundus while roentgenographic plates are made the cannula is equipped with a pet-cock. A Luer syringe connection eliminates the use of all rubber tubing for the oil injections, and if used with a gas medium facilitates a snug connection (Fig. 1).

With the patient preferably in a Sims or knee-chest position, the technic consists of grasping the cervix either laterally or anteroposteriorly as desired with two 5.75-inch tenaculum forceps. The canal is then prepared by cleaning with gauze and painting with mercurochrome or iodine. The cannula is now gently inserted to the metal

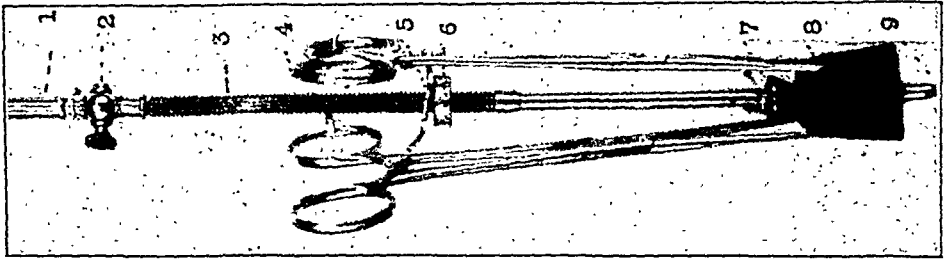


Fig. 1.—1, Luer syringe connection; 2, pet-cock, to retain iodized oil; 3, threaded portion of cannula; 4, two five and three-fourths inch tenaculum forceps; 5, sliding-collar with projection for forceps handles; 6, milled screw to regulate and maintain tension; 7, metal plug for cervical canal to prevent back leakage; 8, rubber cork, represents cervix; 9, perforated cannula tip.

shoulder. (These shoulders are made in two sizes but the large size may be used for all cervixes.) The forceps lock bars are then slipped over the projections on the sliding collar and the milled thumb-screw adjusted to produce a tight connection at the external os.

The instrument is not bulky and as the tenaculum forceps are separate, they can be used to steady the cervix while the cannula is being inserted.

My colleagues and I have used this cannula for more than a year and have found it to be entirely satisfactory. I am indebted to Mr. J. S. Hipple, of the University of Wisconsin, for his skill in the construction of the present instrument.



# Society Transactions

## THE CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF JANUARY 20, 1928

DR. J. P. GREENHILL described a case of **Hematometra Following Labor**.

Mrs. E. L., a negress, thirty-five years old, married fifteen years, was admitted to Cook County Hospital January 19, 1928, complaining of severe pain in the lower abdomen, nausea and vomiting and a chilly sensation, for four months. Her first labor was terminated at term by craniotomy on a dead baby at Cook County Hospital, June, 1927. The patient developed a thrombophlebitis in the left leg and remained in the hospital for three weeks. The patient felt well until three months later when irregular attacks of pain in the abdomen began. On admission, examination showed an extensive amount of scar tissue which covered the lower abdomen and vulva, resulting from a severe burn in childhood. An indefinite mass above the pubis was difficult to outline because of the scar. The vaginal wall was smooth and the external os was flush with the vaginal mucosa. The cervix was entirely above the vaginal vault. The corpus was very soft, cystic, round, movable, and approximately the size of a three months' pregnancy. The lower part of this cystic uterus bulged into the vagina and rectum. The adnexa were negative. These findings, coupled with the fact that the patient had not menstruated at all during the seven months following delivery, made Dr. Greenhill venture a diagnosis of hematometra, but he considered a degenerated pregnancy as a second possibility. When he examined the cervical orifice with the speculum, the diagnosis of hematometra was confirmed, because across the small external os was a thin film which appeared blue in color. This film was incised and about 5 ounces of dark, tarry blood was permitted to escape slowly. The external os was dilated and when a finger was inserted into the uterus it was found that the lower half, the cervix and isthmus, were considerably dilated, whereas the corpus had contracted. (The patient made an uneventful recovery.)

DR. FREDERICK H. FALLS read a paper on the **Diagnosis of Fetal Deformities in Utero**. (For original article see page 801.)

### DISCUSSION

DR. W. A. N. DORLAND said that there is probably no danger in x-rays used for diagnostic purposes and exposure of five to seven seconds is not likely to damage fetal tissue. If any damage were to result it would not be in the formation of monstrosities, these x-rays being taken from the third to the fourth month, at which time the embryo had attained its form. If any damage occurs, it would be in retardation of development of the fetus, either in the muscular or mental development. The cases that have been reported of such retardation in experimental work have probably resulted from too prolonged use of the rays, much longer than would be used for diagnostic purposes.

The recognition of monsters by x-ray prior to birth necessarily will be a slow process as the cases are comparatively infrequent.

DR. D. A. HORNER called Dr. Fall's attention to his inaugural thesis nine years ago in which he demonstrated three monstrosities by means of the x-ray, one of them an anencephalic monster and one a hydrocephalic monster. Dr. Horner doubted whether a definite syndrome can be developed clinically, because monstrosities will surprise the obstetrician by their presence regardless of any physical examination or x-ray picture that may be made. With visual inspection, palpation, percussion, and vaginal examination, one often comes to the conclusion that he is dealing with a monstrosity and at the time of labor finds some sort of malpresentation like a face presentation.

He thought Dr. Falls was right in warning against doing a cesarean section without an x-ray picture being made. He had done that and had been surprised after making a diagnosis and having an x-ray picture of a normal baby to find a monstrosity.

DR. W. H. RUBOVITS said there was a class of cases of abnormalities of the fetus which he considered worthy of attention. Six months ago he delivered a baby by cesarean section with edema of the skin which died on the third day. Clinically, nephritis was demonstrated. In relating the experience a colleague told him that he had a similar case in which an x-ray was taken before delivery. The position of the hands and legs indicated clearly that the fetus was suffering from a tremendous degree of edema of the skin, which was proved on delivery.

DR. J. P. GREENHILL said that five years ago he wrote a paper on the association of fetal monstrosities and placenta previa and since then he has been on the lookout for such cases. From his observations he felt that there is more than a casual relationship between the two conditions. Fairly presumptive evidence of this is the fact that at the Chicago Lying-In Hospital, with about 3,000 deliveries annually, almost half the fetal monsters were associated with placenta previa, during the last nine years.

He was in full accord with what Dr. Falls said about taking x-ray pictures in any case in which the fetal head is not definitely palpable. This is especially to be emphasized in placenta previa where monsters are not thought of.

Many obstetricians urge cesarean section because of the greater safety to the baby. It is very unpleasant to tell the parents this and then deliver a monster. Dr. Greenhill then showed a number of x-ray plates of various types of monsters in utero. Dr. Falls said that in 1925 Daub reported the first case of hydrocephalus detected by the x-ray, but Dr. Greenhill said that in 1923 in a paper on "X-ray in Obstetrics" he published an x-ray picture showing a hydrocephalus in utero.

DR. FALLS, in closing, said that if he is not sure he can palpate the fetal head externally he makes a vaginal examination. If, on palpation, there are abnormal fetal movements, or if the heart tones go down to an unwarranted degree, sixty, seventy or eighty, without evidence that the head is being unduly compressed by the pelvic bones, he takes an x-ray picture. He has never had a case in which he suspected the presence of anencephalic monster from these points which was not confirmed by the x-ray examination. Spina bifida will not give this syndrome. There is no change in the heart tones. There is no difficulty in palpating the head and unless for some other reason one makes an x-ray examination the deformity will not be found before delivery.

Dr. Rubovits' presentation of the fetus in peculiar position reminded him of a case in which he made a similar diagnosis in 1917 and in which there was no abnormality of the fetus such as a tumor of the neck or edema of the skin but in which there was complete opisthotonos. He made the diagnosis because he could not keep the head over the inlet. The baby was in the transverse position. He

reported the case in *Surgery, Gynecology and Obstetrics*. As far as he could find there were no other cases of that kind reported, although Williams said there were some drawings of this kind in the old German textbooks and Dr. DeLee said he had seen a case but had not reported it.

As far as placenta previa and monstrosities are concerned, Dr. Falls said if he found a central placenta previa, even if he knew it was associated with a monstrosity, he would treat the central placenta previa and disregard the deformity. In central placenta previa he considers cesarean section the safest procedure. In other types of placenta previa he would be inclined to avoid doing a cesarean section in the case of a monstrosity because the value of saving such a baby is nil.

There is danger in a misinterpretation of x-ray pictures. Recently he had occasion to x-ray a patient and the report came back from the laboratory, "fetal death because of overlapping of the skull bones." He was able to hear the heart tones and diagnosed and delivered a live baby, notwithstanding the fact that he felt the interpretation of the x-ray picture was right. Therefore, until further observations are made, he should hesitate to make a diagnosis of fetal death merely from apparent overlapping of the skull bones.

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## THE CHICAGO GYNECOLOGICAL SOCIETY

MEETING OF FEBRUARY 18, 1928

DR. O. S. PAVLIK read a paper entitled **Preservation of Ovary by Means of Intrauterine Transplantation in Radical Operations for Adnexal Disease.** (For original article see page 867.)

### DISCUSSION

DR. W. McI. THOMPSON said that in his experience the vascular pedicle is the essential requisite in transplanting an ovary. Only where the ovary was transplanted with a vascular pedicle has he had any success in retaining its function.

DR. JOSEPH L. BAER believed that the transplantation of the detached ovarian tissue, however it may be preserved or wherever it may be placed, is of so temporary a value as to be comparatively futile and carries with it an element of risk, for, if the ovary is in a subject who has acute or subacute adnexal disease there is likelihood of infection secondary to the transplantation. If then, the better scheme is to preserve the ovary with its vascular supply when feasible, why would it not be preferable to preserve the ovary in situ in proper relation to the broad ligament rather than to insert it into the uterine cavity. If the ovary can be preserved at all, it would be better to trim off the diseased tube and leave the ovary free on its pedicle and in its comparatively normal relationship to the broad ligament. That has been his practice over a considerable period of time. In his experience such an ovary may undergo cystic degeneration during the first half year following operation. If that patient is seen by some other operator during that period he may say she has an ovarian cyst that should have been removed by the previous operator, whereas if the patient is left unoperated for a year the cyst subsides and the patient has to all intents and purposes a normal ovary. For this reason he is doubtful of the value of dislocating the ovary which retains its vascular supply.

DR. CARL H. DAVIS said he wished to second the remarks of Dr. Baer but to differ from him in one particular. Sometimes it is not possible to leave ovarian

tissue in the abdomen and yet from a purely psychologic point of view it is worth while to transplant a piece of ovary into the rectus muscle and within three months there will be evidence of ovarian function. Periodic enlargement of this ovarian tissue can be followed for several years. The very fact that the woman knows she has ovarian tissue is going to be of value to her mentally even though it gives nothing more than a scant menstrual flow for a few years. He has treated eighteen or twenty patients and several who have menstruated more or less regularly.

DR. PAVLIK, in closing, said that a great deal depended upon the mentality of the individual. If the woman is fairly intelligent and one can explain to her that on account of her condition pregnancy is out of the question and that menstruation is not necessary to her well-being, she may go along without much disturbance. Unfortunately, they are not all of that type, so in cases where it is not possible to make a transplant with the blood supply of the ovary intact, Dr. Pavlik believed that cutting out as much of the healthy ovary as possible and transplanting it is an advantage to the patient even if it remains in place for only six months or a year. Most of the patients in the series were service cases from the Cook County Hospital and naturally difficult to follow-up. Some of these ovaries probably became cystic. Just because a patient does not always return, this should not lead the operator to believe he has cured the patient.

DR. J. P. GREENHILL read a paper entitled **Vaginal Discharge Due to Trichomonas Vaginalis**. (For original article see page 870.)

#### DISCUSSION

DR. CARL H. DAVIS said that recently he had found these organisms in two cases. These patients had been in the habit of taking douches just before coming to the office; on one occasion they both came without having taken a douche and the organisms were found.

As regards treatment, it would seem that the use of a lactic acid douche as part of the treatment might favor recurrence of the infection if it is true that these organisms can only live in an acid media. Lynch states that cultures can only be grown in acid broth. A treatment which seemed to work very nicely in one of his patients was to thoroughly dry out the vagina then to fill the vault with an alkaline powder, thoroughly rubbing it into every crevice. When she returned the next week the irritation in the vagina had practically cleared up. She had no discharge and there was no microscopic evidence of the infection.

DR. IRVING F. STEIN said that he had looked for trichomonas in cases with intractable leucorrheas, with profuse discharge, itching, burning and odor, and found them in a number of cases but was never convinced that they were the causative organisms, believing them to be contaminants. He had never used the acid treatment. He has used alkaline treatment, even resorting to the old alkaline powder, "bolus alba."

One patient who developed this type of leucorrhea two years after a vaginal hysterectomy done in another hospital, came in with a granulomatous mass in the vault of the vagina. Dr. Stein removed this with the cautery and on section it proved to be a fallopian tube which had prolapsed into the vagina. She was relieved of the discharge for a time but a year and a half later came in with this typical greenish, foul, acrid discharge in which the trichomonas were found. He treated her for some time without success.

DR. GREENHILL, in closing, said that the patients are specifically instructed not to take douches on the morning they come for treatment, because sometimes the douche removes the organisms chemically or mechanically. The organisms live in any medium, acid or alkaline.

Lactic acid is prescribed because it tends to reestablish the normal bacterial flora. A number of German and Russian obstetricians prescribe douches of lactic acid before and during labor and claim they have definitely reduced their mortality and morbidity because of this procedure. Lactic acid douches more nearly restore the normal bacterial flora than anything else. Dr. Greenhill said he also had tried alkalies some years ago but without success.

All the patients in this series were treated because they actually complained of the discharge and only those patients were included whose last treatment was given at least two months ago.

DR. ALEXANDER M. CAMPBELL read a paper on **Chorea Gravidarum**.  
(For original article see page 881.)

#### DISCUSSION

DR. CAREY CULBERTSON said that as the speaker was inclined to put this complication on an infectious basis, a review of the whole subject of chorea is in order. Chorea has not been considered in that light and he was not aware that the neurologists have placed it in that category. Dr. Culbertson said he was interested in knowing the character of the children born of choreic mothers, and asked whether in the review of the literature the cases reported disclosed the character of the children not only anatomically but mentally. Some choreics are definitely subnormal; some of the mild types are plainly enough intelligent and capable of education but some of them are not. Some of them are imbeciles.

DR. FRED H. FALLS asked if there was any evidence in the literature of a transmission of this infection to the child; if the children had any choreic spasms shortly after birth. He believed chorea was an infectious process. Rosenow recovered streptococci from the blood of choreics. Whether or not that proves to be a definite etiologic factor in the cause of chorea, time will tell. Dr. Falls cited a rare case that proved to be Huntington's chorea. The woman went through labor and delivered the baby and the baby lived. He did not feel it was necessary to induce labor. She had about the same degree of chorea when she left the service as before delivery. He had some experience with choreics at the Cook County Hospital but in none of these was a cesarean section performed. His feeling was that the danger from cesarean section with the inability to control the patient was greater than to allow her to go on and abort spontaneously in early cases or to let her deliver through the natural passages under ether when term was near.

DR. J. P. GREENHILL said that at the Chicago Lying-In Hospital he recalled two patients with chorea. One miscarried and the other went through two pregnancies and delivered spontaneously both times.

DR. ABRAHAM F. LASH said he saw one case of chorea gravidarum at the Cook County Hospital in 1922 of a woman in her fourth pregnancy and it was the first time she displayed symptoms of chorea. Dr. Lee aborted her vaginally and the chorea subsided. Two years later she returned to the hospital when four months' pregnant and again showing symptoms of chorea which rapidly became

worse. Dr. Hillis did an abdominal hysterotomy, following which the chorea subsided up to the extent that she only had slight movements in her left hand.

DR. I. F. STEIN said he was not aware that there was so high a fetal or maternal mortality in chorea gravidarum until Dr. Campbell brought it out. He recalled two cases of chorea occurring in two sisters who had been in and out of Michael Reese Hospital many times in many years. They both had chorea in adolescence and both had it in two successive pregnancies. In neither was labor induced. They were treated by rest in bed and isolation from visitors and delivered spontaneously.

He did not think medication was important, but rest in bed was a necessity. He had seen no deaths in either the mothers or babies, though their series included perhaps five or six cases.

DR. RALPH REIS said that the two sisters referred to by Dr. Stein had had five children. The smaller one of the two was a high grade moron. She had had three children. She was met in the hallway of the hospital and a diagnosis of the third pregnancy was made on sight by the fact that she had again developed a chorea. In this patient choreiform movements were only present during pregnancy.

DR. CAMPBELL, in closing, said he found nothing in the literature concerning the mentality of the children of choreic mothers. He doubted very much whether neurologists would accept infection as a sole etiologic factor, but the work of certain German investigators formed the basis for this conclusion and he felt that sooner or later the neurologists would have to accept it. However, he would not give the impression that all cases were of infectious origin. Poynton, Paine and Holmes isolated an organism, inoculated rabbits, produced choreic movements in them and recovered the organism.

Dr. Campbell was not radical on cesarean section, but felt that the operation was justifiable in the case cited. The woman was of a low type mentally and he preferred to do a cesarean section and sterilization at the same time.

The fetal mortality of fifty per cent included the abortions, miscarriages and premature deliveries. From the literature, he is convinced that the maternal mortality is exceedingly high.

# Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

## Selected Abstracts

### Endometriosis

Waeggeli, C.: *Heterotopies of Uterine Mucosa*. *Gynécologie et Obstétrique*, 1926, xiv, 158.

Endometrial transplants are most often found in the ovaries, on the pelvic and intestinal serosa, and in the rectovaginal pouch. It has been shown that they are only found in women of full sexual maturity and that they take part in all phases of the menstrual cycle. Also decidual transformations have been described. They are found occasionally on the serous surface of the uterus.

The author believes that there exists a predisposition to weakness of the uterine muscle favoring its invasion by the endometrial mucosa. In regard to Sampson's theory the author holds that there can be no doubt of a back flow from the uterus through the tubes into the abdominal cavity. Halban's theory of the formation of metastases through the lymphatic channels so far has not been confirmed by others. There are definite objections. The author thinks that various types of this growth may have various origins. Thus uterine adenomatosis is no doubt due to direct invasion. The transplants in the peritoneal cavity probably occur according to the idea of Sampson, but in certain other cases from the wolffian or müllerian tubes, etc. The author rejects for the time being the metaplasia theory and the theory of Halban.

In the majority of cases the outstanding symptom is an intractable dysmenorrhea, sometimes with metrorrhagia. Further symptoms will be due to progression and the various reactions occurring in various types of growth. The uterus is generally enlarged, often retroverted and fixed and frequently closely adherent to the rectum. A very characteristic finding is the presence of rather firm nodules in the uterosacral ligaments, pouch of Douglas, rectum, or base of the anterior culdesac. There is apt to be a primary or secondary sterility. The prognosis appears good, for in spite of their tendency to proliferate and disseminate, these growths show no malignant tendency. Malignant degeneration has only very exceptionally been observed. The treatment is surgical. X-rays have not been efficacious. Experience has shown that where complete removal of the growth is impossible, a partial extirpation will halt development. Ovarian castration brings about an atrophy of the growths which are under the domination of the ovarian secretion. The author wonders if certain peritoneal and retroperitoneal cysts originating in embryonic inclusions may not be the beginnings of these growths. He even suggests that pseudomucinous cysts of the ovary might start from uterine mucosa transplanted on the surface of the ovary.

GOODRICH C. SCHAUFLER.

Halban, J.: *Hystero-adenosis Metastatica*. The Lymphatic Origin of the So-Called Adenofibromatosis Heterotopica. *Archiv für Gynäkologie*, 1925, cxxiv, 457.

Halban reports five cases of this condition which he prefers to call hystero-adenosis metastatica rather than heterotopic adenofibromatosis, adenomyosis, endometrioma,

chocolate cysts, etc., as other investigators have named tumors containing uterine mucosa and found in the pelvic and abdominal organs other than the uterus. He believes that these tumors are true metastases carried from the uterus by way of the lymphatics and shows that they are always found along the course which the uterine lymphatics follow in the abdomen. He feels, however, that these metastases are benign.

Halban disagrees with the implantation theory of Sampson because he cannot believe that uterine mucosa, which during menstruation is necrotic, dead and stains poorly, can be active enough and alive enough to grow again if it comes in contact with other structures. Secondly, he cannot understand how such a mucosa could penetrate the thick tunica albuginea of the ovary. He also states that it is impossible to reconcile the implantation theory with these structures when found in the umbilicus and in laparotomy scars.

The lymphatic distribution of such bits of uterine mucosa which, when deposited on various structures, develop hyperplastically is proved by the following facts: Meyer, Frankl, Lahn and others have demonstrated the existence of bits of uterine mucosa in the lymphatics of the uterine wall and have traced them to the serosa of the uterus. There then seems to be no reason why the lymphatics cannot carry such bits of endometrium along their entire course and deposit them at various points throughout the abdomen. Secondly, Ries, Wertheim and others have found bits of uterine mucosa in all the regional lymph glands, i.e., inguinal, sacral, iliac and parametrial groups of glands. Thirdly, these masses of epithelial cells resembling uterine mucosa are never found in the male but only in the female, and only, in the female, in those glands which receive the lymphatics from the uterine wall.

Since the lymphatics from the uterus drain into the rectovaginal septum, toward the ovary, mesosigmoid and mesoappendix, umbilicus and abdominal wall, all growths in these locations and even in laparotomy scars, can readily be explained by the theory of lymphatic distribution.

RALPH A. REIS.

O'Keefe, C. D., and Crossen, R. J.: Autotransplantation of Endometrial Tissue in Dogs. *The Journal of the Missouri State Medical Association*, 1927, xxiv, 252.

The authors experimented on ten dogs. They obtained transplants in only two cases but believe that the failures were due to technical shortcomings and had nothing to do with the tissue vitality. They believe that the outcome of their experiments tends to support Sampson's theory.

A. C. WILLIAMSON.

Spirito, Francesco: Genesis of Endometriomata. *Archivio di ostetricia e ginecologia*, 1927, xiv, i.

Spirito transplanted pieces of uterine mucosa, pieces of the uterine wall, peritoneal scrapings, pieces of the peritoneum, ovarian epithelium, small pieces of ovary, intestinal mucosa, stomach and esophagus and found that the only tissue which would grow upon the peritoneum was uterine mucosa. This growth showed all the histologic characteristics of uterine mucosa with cystic glands.

He also made a uteroabdominal fistula and injected air into the uterus and through the tubes into the abdominal cavity. At autopsy all these animals showed cystic growths on the peritoneum of either the pelvis or the abdominal cavity, or both.

He believes that his researches help to substantiate Sampson's theory as to the



origin of endometriomas. He says, however, that he cannot satisfactorily explain why the Rubin insufflation procedure does not also produce endometriomas.

J. M. PIERCE.

**Jacobson, Victor C.: Intraperitoneal Transplantation of Endometrial Tissue.** Archives of Pathology and Laboratory Medicine, 1926, i, 169.

The author experimentally transplanted endometrial tissue in rabbits and monkeys (macacus rhesus). Only autotransplants were used. Of the 19 rabbits experimented on during estrus, the grafts were successful in 16 cases. In 6 operated upon during pregnancy, implantation was successful in 2. The ectopic growths which were invariably cystic adenomas were recovered from the pelvic viscera and in some cases from the large bowel, on its peritoneal surface.

Of the 5 monkeys so treated the curetted transplants were more confined to the uterus and adhesions about it. The "reaction to implantation" was studied at three weeks, eight months, and one year after the operation. In one case the ectopic endometrium was found in the menstrual stage. The successful autotransplantation of endometrium in both experimental animals used in this series is analogous to the phenomenon of ectopic endometriosis in the human female with respect to location, histology and response to ovarian secretion. This experimental work further substantiates Sampson's theory of the origin of ectopic endometriosis in the human.

W. B. SERBIN.

**Lemon and Mahle: Ectopic Adenomyoma: Postoperative Invasion of the Abdominal Wall.** Archives of Surgery, 1925, x, 150.

Lemon and Mahle observed nine patients with adenomyoma occurring in the scar of an abdominal operation. In none of these cases were adenomyomas demonstrable in any other location. All of the patients has been subjected to operations on the female genitalia at some previous time. Histologically all of the tumors examined presented the usual picture of adenomyoma with connective tissue and smooth muscle stroma and typical endometrial tissue and occasional cysts filled with blood and cell debris.

The authors review the various theories advanced as to the origin of ectopic adenomyoma quoting all the more or less obsolete ideas on the subject but, strangely enough, ignore absolutely the extensive work on this subject by Sampson. On the other hand they advance as a plausible theory of their own that they may be due to uterine mucosa transplanted at the time of operation.

R. E. WOBUS.

**Maes, Urban: Endometrioma of the Abdominal Wall: American Journal of Surgery, 1927, xi, 539.**

Maes endeavors to throw further light on the etiology of endometrial cysts in the publication of his article dealing with a tumor in a scar of the abdominal wall. He reopens the argument fostered by Novak and Sampson and rather agrees with Novak. However, he is inclined to agree with Judd in the explanation of his own case in that the transplantation is brought about by means of the needle and suture materials passing through the endometrium and bringing fragments of it to rest in the abdominal musculature. Mac's patient, eight years previously, had had a supravaginal amputation and soon afterward the abdominal scar began to hypertrophy. Small cystic cavities formed from which sanguinous fluid was evacuated. The scar was removed and microscopically showed endometrial transplants.

WILLIAM KERWIN.

Kitai, I.: The Inflammatory Origin of Atresia and of Heterotopic Epithelial Proliferation in the Tubes. *Archiv für Gynäkologie*, 1926, cxxviii, 413.

On the basis of careful microscopic studies made on seven cases, Kitai concludes that atresia and heterotopic proliferation of the mucosa almost always follow inflammation of the tube and are not due to congenital malformations. These latter have been demonstrated in almost every portion of the female genital tract but have never been found in the tubes. The hypothesis of malformations, as advanced by Schidde and Schoenholz, cannot explain the excessive growth and heterotopic proliferations which are occasionally found in the tubes. Every instance of such atresia with heterotopic proliferation can easily be explained on the basis of a preexisting inflammation with the resulting inflammatory changes. These are usually gonorrheal in origin.

RALPH A. REIS.

Cordua, R.: Epithelial Hematomata and Endometroid Formations of the Ovary. *Archiv für Gynäkologie*, 1926, cxxviii, 617.

Cordua concludes that epithelialized hematomas of the ovary may originate from various sources such as corpus luteum hematomas or interstitial hemorrhages which become lined with epithelium by an ingrowth from the germinal layer, or from endometroid formations or other types of epithelialized cysts. Such hematomas are produced by the tendency to bleed which exists at the menstrual periods and they apparently bleed repeatedly.

The author leans toward the theory of endometroid formation from serosa epithelium and does not feel that the implantation theory has been satisfactorily proved.

RALPH A. REIS.

Dawson: Ovarian Pregnancy and Endometrioma. *Medical Journal of Australia*, 1926, ii, 233.

The writer believes that the comparatively frequent occurrence of ectopic endometrial tissue in the vicinity of the ovaries has an important influence on the origin of the ovarian pregnancy. Spermatozoa not uncommonly reach the pelvic cavity. Graafian follicles are maturing and ova being liberated and nevertheless ovarian pregnancy but rarely occurs. The reason for this rarity, he believes, is that another factor is required: namely, the presence of some endometrial tissue. Transplanted endometrial tissue in or about the ovary provides what may be called a miniature auxiliary womb. The writer has collected considerable suggestive evidence in favor of his viewpoint; thus he states that the possibility of fertilization of the ovum within the pelvic cavity is generally accepted. Secondly, consideration of the philogenetic attraction between zygote and endometrial mucosa suggests that the latter is an essential factor in the implantation of the impregnated ovum. Thirdly, the comparative frequency of impregnation taking place in the pelvis and the extreme rarity of ovarian pregnancy suggests the necessity of another factor for its occurrence. Fourthly, in many carefully examined and described specimens of ovarian pregnancy it is clear that impregnation did not occur in the graafian follicle for a maturing corpus luteum can be seen separate and distinct from the gestation sac. Finally, the coexistence of endometriomas of other pelvic viscera and ovarian pregnancy has been seen in at least one case.

The writer reviews cases which tend to further bear out his views.

NORMAN F. MILLER.

## Books Received

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DIATHERMY. By Elkin P. Cumberbatch, medical officer in charge, electrical department, St. Bartholomew's Hospital, etc. Second edition. C. V. Mosby Co., St. Louis, 1928.

RECENT ADVANCES IN CHEMISTRY IN RELATION TO MEDICAL PRACTICE. By McKim Marriott, B.S., M.D., dean, and professor of pediatrics, Washington University School of Medicine, etc. Illustrated. C. V. Mosby Co., St. Louis, 1928.

TROPICAL GYNAECOLOGY. By V. B. Green-Armytage, professor of obstetrics and gynaecology, Medical College, Calcutta, etc. Calcutta and Simla, Thacker, Spink and Co., 1928.

THE TECHNIC OF LOCAL ANESTHESIA. By Arthur E. Hertzler, professor of surgery in the University of Kansas, etc. Fourth edition. With 146 illustrations. C. V. Mosby Company, St. Louis, 1928.

BLOOD AND URINE CHEMISTRY. By R. B. H. Gradwohl, director of the Gradwohl laboratories, and Ida E. Gradwohl, instructor. With 117 illustrations and 4 color plates. C. V. Mosby Co., St. Louis, 1928.

GREFFE OVARIENNE ET ACTION ENDOCRINE DE L'OVAIRE. Par Vittorio Pettinari. Avec 181 figures dans le texte. Paris, Gaston Doin & Cie, 1928.

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## Erratum

In the discussion of Dr. B. P. Watson's paper entitled "An Outbreak of Puerperal Sepsis in New York City," which was read at a meeting of the New York Obstetrical Society of which the transactions were published in the August issue of this Journal, the remarks made by Dr. J. Milton Mabbott were unfortunately omitted from the record and are herewith presented in substance.

Discussing this subject Dr. Mabbott said that he desired to refer particularly to the treatment of puerperal sepsis and stated his belief that the results as regards the mortality from this complication of pregnancy were as good forty years ago as they are today. He felt that at least a small proportion of the cases in an epidemic of puerperal sepsis should be subjected to a trial treatment by the vaginal douche early and the intrauterine douche later on in the course of the disease in patients in whom the streptococcus is found in the vagina and in whom it is assumed that probably a good deal of the infection goes through the lymphatics from the cervix and uterine cavity.

Dr. Mabbott then referred to the use, at a later period, of vaccines in puerperal sepsis and instanced a case in his private practice of a remarkably favorable response within twenty-four hours after a single subcutaneous injection of a stock culture. In view of this experience Dr. Mabbott would reply to Dr. Meleney's question as to what should be done in a case of puerperal sepsis by saying "use a vaccine."

Finally the experience in the late war, with infected wounds, should teach us the wisdom of protecting the vagina and uterus against infection by doing away with the contained lochia. In the presence of the streptococcus hemolyticus, such lochial discharges would serve as an excellent culture medium and should therefore be cleaned out by the means already referred to.

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### References. (Read these.)

<sup>1</sup>Billings, J. S.: Our Medical Literature, Trans. VII Intern. Med. Congress, Lond., 1881, i, 54-70.

<sup>2</sup>Mayer, Emil: Medical Literature and its Preparation, Med. Record, N. Y., 1915, lxxxvii, 1019-1021.

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<sup>3</sup>Suggestions to Medical Authors, issued by the A. M. A. Press, Chic., A. M. A., [1914 (?)].

<sup>4</sup>Place, F.: Bibliographic Style in Medical Literature, Med. Record, N. Y., 1913, lxxxiii, 157-160.

